The FOUNDRY

Volume 58
Number 9

Published
Semimonthly

CLEVELAND, OHIO, MAY 1, 1930

Daily Edition of the Foundry To Carry Convention News

WITH the annual convention and exhibition of the American Foundrymen's association just around the corner, the eyes of the foundry world are directed toward Cleveland. This issue of THE FOUNDRY carries to the industry complete and detailed information on the many events which will be crowded into the busy convention week. Plans for the technical program, the shop operation courses, the general entertainment features, the plant visitation program, special entertainment for the ladies and the great exhibition are covered in complete detail.

During the convention, The Cleveland Convention Daily edition of THE FOUNDRY will carry the latest news of every activity. The entire staff of THE FOUNDRY augmented by other editors from the large organization of the Penton Publishing Co. will cover every event of interest for this full sized newspaper which will be published on Monday, Tuesday, Wednesday and Thursday of convention week. With the gathering resembling a three ring circus, something doing every minute, no visitor can afford to be without the Cleveland Convention Daily. It will be distributed throughout the exhibition, at the technical sessions and also may be obtained at THE FOUNDRY headquarters, booths 96, 98 and 100 in the main arena of Public Auditorium.

Study the pages following to learn of convention plans, don't fail to secure your copies of the Cleveland Convention Daily during the convention and watch for the Post Convention, June 1 issue with its full report of all events that occur during the week.

CONTENTS

FEATURE ARTICLES

Page

Cleveland Foundries Supply Castings for Diversified Industries 168
Industry Awaits Opening 176
Cleveland Committee Provides Entertainment Program 181
Equipment Developments Will Feature Great Foundry Show 188
Over Annealed Steel Is Recognized Through X-ray Spectrometry—By H. A. Schwartz 197
Bill Comments on High Hats and Spark Arresters—By Pat Dwyer 204
Gray Iron Possesses Valuable Engineering Properties—Part IV 209
Malleable Foundry Makes Wagon Skeins—By Norman F. Hindle 214
Fundamentals of Foundry Practice—Part IX—By Ivan Lamoureux 220

REGULAR DEPARTMENTS

Questions and Answers on Foundry Practice 200
Problems in Nonferrous Founding — By Charles Vickers 203
The Foundry Family Photograph Album 207
The Foundry Data Sheet 208
The Shakeout 224
Comings and Goings of Foundrymen 225
Trade Trends in Tabloid 227
What the Foundries Are Doing 228
New Trade Publications 228

PUBLISHED BY THE PENTON PUBLISHING CO.,
Penton Building, Cleveland, O.
BRANCH OFFICES

CHICAGO.....1347 Peoples Gas Bldg.
CINCINNATI.....209 Edwards Bldg.
NEW YORK.....2203-2206 No. 220 Broadway
PITTSBURGH.....2148-49 Oliver Bldg.
SAN FRANCISCO.....24 California Street
WASHINGTON, D. C.....1653 Pennsylvania Avenue
LONDON, ENGLAND.....416-417 Caxton House, Westminster, S. W. 1
BIRMINGHAM, ENGLAND.....14 New Street
PARIS, FRANCE.....No. 9 Rue de Londres
BERLIN, GERMANY.....Dahlmerstrasse 64A, Berlin Lichterfeld-West

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....£1:0:0 a year
Single Copies.....25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers Inc., National Publishers' Association

The A. B. P. is a nonprofit organization whose members have pledged themselves to a working code of practice in which the interests of the men of American industry, trade and professions are placed first—a code demanding unbiased editorial pages, classified and verified subscribers, and honest advertising of dependable products

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Cleveland Foundries
Supply Castings for
Diversified Industries

Representative Shops Will Open Doors To Visitors Attending the Annual Convention of the A. F. A.

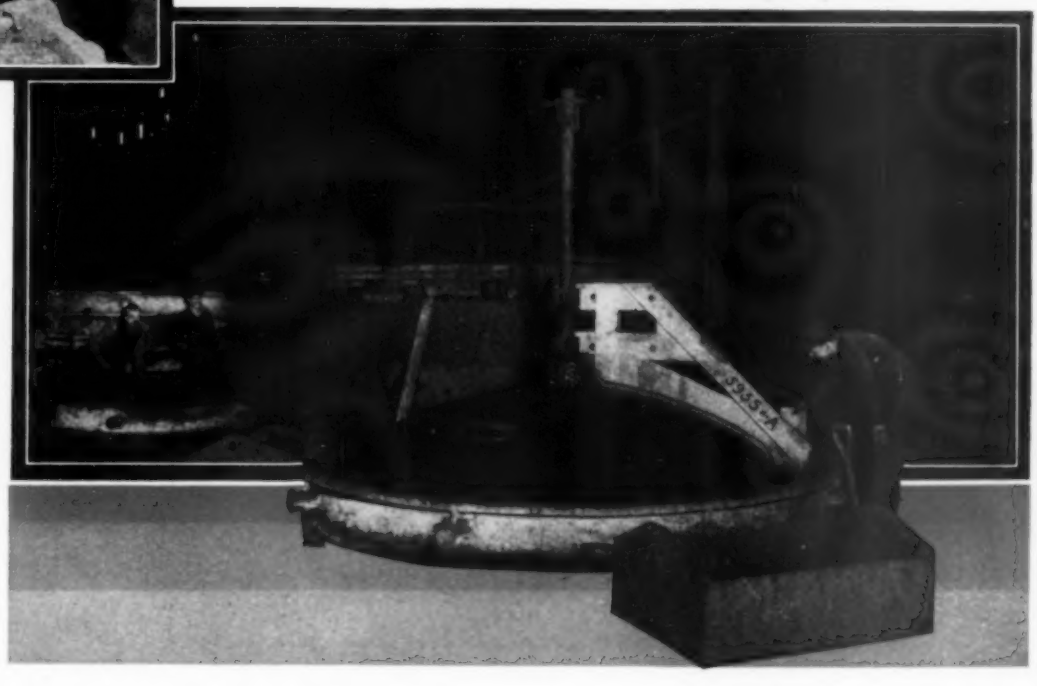
CLEVELAND with 112 foundries is the second largest foundry center in the United States. In addition, its geographical location places it in the center of a circle with a 500-mile radius that embraces more than half the population of the country and more than half the industrial establishments where castings of one kind and another are utilized. Selection of this city for the 1930 convention and exhibition of the American Foundrymen's association is particularly appropriate. In its capacity of caterer to many varied industries, the city is a real foundry town, with a personnel numbering among its members many veterans who have participated in the evolution of the industry from the rule of thumb days to the present.

Out of the large number of foundries available for inspection, the plant visitation committee has selected 12 representative shops and has arranged with the proper authorities in these various plants for the reception of visitors during the convention period. The selected list of foundries shown on a succeeding page includes seven which specialize in cer-

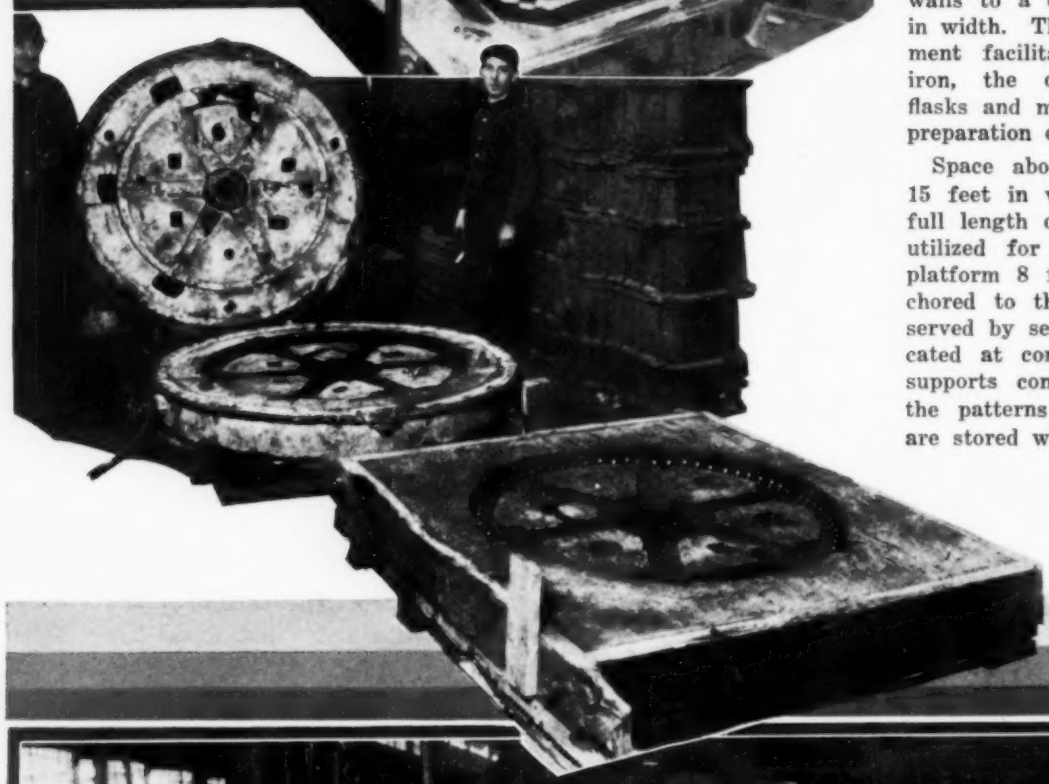
Semiproduction methods are practiced where duplicate castings are ordered in comparatively large numbers—Automobile castings are molded, cored and poured in transit

tain classes of gray iron castings, two in which steel castings are made, and one each devoted respectively to the production of brass and malleable iron castings. With the names arranged in alphabetical order for convenient reference, the location and other pertinent data are given in a reference on page 213.

The largest foundry in the group is the Harvard avenue plant of the Cleveland Co-operative Stove Co. This company in point of continued existence is one of the oldest in the Middle West. The original charter was taken out in 1867. The old plant at Central avenue and East 67th street with



The electric furnace has come rapidly to the front for the production of steels for small and medium weight castings. The spindle and sweep still are employed in the formation of large sand and loam molds



accommodation for 100 molders is equipped throughout for making all the essential parts and assembling them in complete heating and cooking units. Castings from the comparatively new plant at Harvard avenue near East 28th street also are assembled in the old plant.

With 135,000 square feet of floor space the new foundry is one of the largest in the country under one roof. It is 135 feet in width and 1000 feet from end to end. With the exception of a space 35 x 60 feet under each of the cupola charging platforms and another space 50 x 135 feet at one end devoted to the production of cores, it is laid off into molding floors with a uniform length of 60 feet extending from the side walls to a central gangway 15 feet in width. This simplicity of arrangement facilitates the distribution of iron, the orderly arrangement of flasks and molding machines and the preparation of the sand at the floors.

Space above the central gangway 15 feet in width and extending the full length of the building has been utilized for a pattern storage. A platform 8 feet above the floor anchored to the building columns and served by several short stairways located at convenient distances apart, supports continuous racks on which the patterns and pattern equipment are stored while not in use. A light monorail suspended from the under side of the main longitudinal

beam supporting either side of the gallery is used during the casting period to carry the hand ladles. A number of straight rods terminating in rings at the lower end and in suitable rollers at the top end are employed to support the ladles. The man places the bowl of his filled ladle in the ring and then pushes the load to his destination.

Molds for an almost limitless variety of stoves and ranges, designed to operate on any kind of fuel, coal, coke, oil, gas, wood or electric current are made on 125 pneumatic squeezer machines. A few of the larger molds are rammed on the floor by hand, but nearly all the stove castings and a limited quantity of small miscellaneous castings are molded on the squeezing machines.

A few years ago the company took up the manufacture of hot air furnaces in five different sizes. A section of the floor between the third cupola and the core room at the south end of the foundry was set apart for the manufacture of furnace sections on one side of the gangway and of gas heater casings on the other side.

In contrast to the foundry of the Westinghouse Electric & Mfg. Co., and the foundries of the Forest City-Walworth Run Foundry Co., where practically all the patterns are mounted for machine molding, the Nickel Plate Foundry Co., and the Kilby Mfg. Co., handle a class of castings where a great deal of the work is in the hands of widely experienced and highly skilled molders of the old school. On account of the expense involved where only one or

two large castings are required, complete patterns are the exception rather than the rule at the plant of the Kilby company. Skeleton patterns, sweeps, cores, drawbacks and other devices are employed extensively in building the molds for this class of castings. Many of the large molds are made in green sand, but the majority either are skin dried, or dried in the oven. Outside parts of loam molds usually are dried where they stand. Coke fires enclosed in suitable iron baskets, standard or special shapes are employed for the purpose. In some instances it is possible to lower the cope into place and thus dry it at the same time.

The Kilby Mfg. Co., with complete facilities for machining and assembling its product was established in 1888 and for many years has specialized in the manufacture of sugar mill equipment destined for operation in practically every country in the world where sugar cane and sugar beets are cultivated.

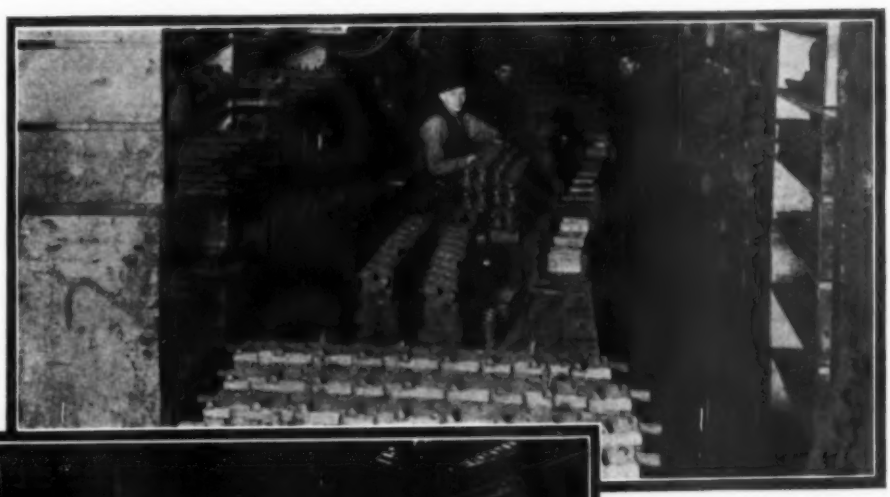
The Nickel Plate Foundry Co. was established in 1919 to handle a general line of jobbing castings. Many of the light castings are made on the bench and on machines, but the heavy castings are molded in the floor or in large iron flasks. The mold for a long planer bed is shown partly completed in one of the accompanying illustrations. The part pattern first was utilized to form one-half the mold and then was moved forward to complete the second half.

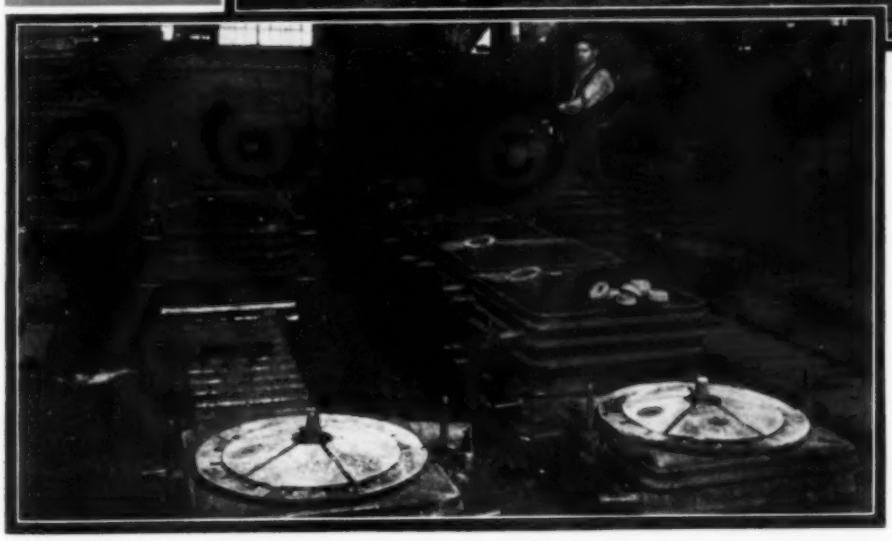
Cleveland was one of the first foundry towns to enter the automobile casting field. It is claimed that D. J. Ryan, president of the Allyne-Ryan Foundry Co., cast the first cylinder many years ago when he was superintendent of the old Interstate foundry. He broke an imported French cylinder open to study the construction and then had the pattern and coreboxes made to his instruction. In 1913 he formed a company to build his present plant and for many years set the pace in development and installation of many ingenious

methods and equipment for producing cylinders and other intricate castings for the automobile industry. Graduates of his plant are at the head of, or are holding important positions, in many of the leading automobile plants throughout the country, and the benefit of his experience has been conferred freely upon other automotive manufacturers.

Organized originally in 1900 to build marine motors, the Ferro Machine & Foundry Co., soon entered the automobile casting field and rose to be one of the leaders. Prominent foundrymen connected with this plant at various periods include Charles and D. R. Wilson, who later formed the Wilson Foundry & Machine Co., Pontiac, Mich.; E. W. Beach, now with the Campbell, Wyant & Cannon Co., Muskegon, Mich., and John T. Stoney now president of the Stoney Foundry Equipment & Engineering Co., Cleveland. These men and others who have succeeded them have helped to make automobile casting history.

The West Steel Casting Co., was established in 1906 by the late Thomas D. West, a prominent foundryman and one of the pioneers in the application of science to the foundry industry. Through his contributions to technical literature and his active participation in all movements affecting the foundry industry, he was, perhaps, the best known foundryman of his time. The plant now is conducted by Ralph D. West, who succeeded his father as president of the company.





The plant originally was equipped with two converters and two cupolas for melting the steel, but in recent years these have been superseded by an electric furnace for the production of plain carbon and alloy steels.

Castings are made in green sand and dry sand molds for a widely diversified line of industries. One section of the shop is equipped with roller conveyors, molding machines, shakeout, and sand handling equipment for castings made on a produc-

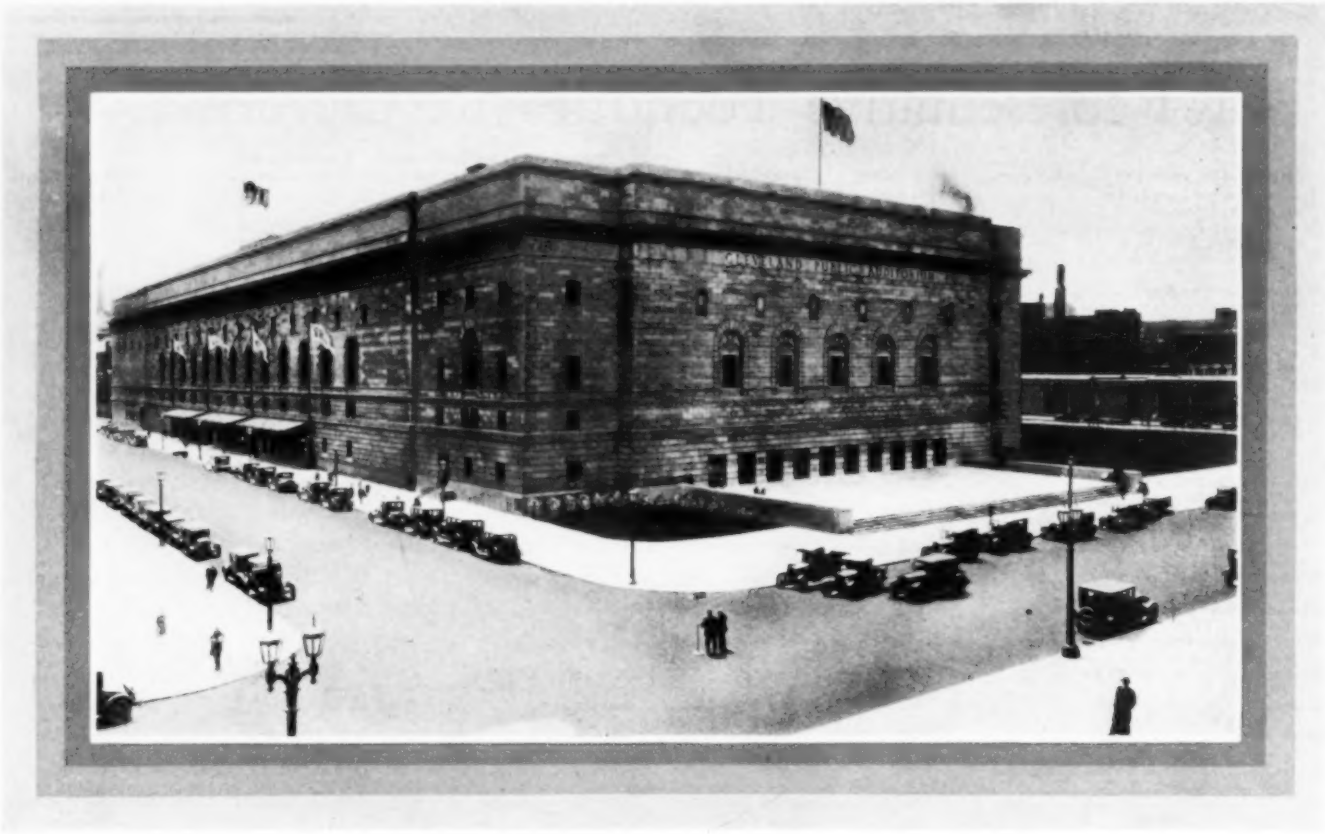
(*Concluded on Page* 213)

Representative Foundries in Cleveland

Name and Address	Established	Metal Melted	Class of Castings	Daily Output in Tons	President or General Mgr.	Foundry Supt.
Acme Foundry Corp. 5217 Sweeney Ave., S. E.	1900	Gray Iron	Jobbing Light & Medium	15	Wm. Greenebaum Howard Greenebaum	Peter G. Klein
Allyne-Ryan Foundry Co. Aetna Rd. & E. 91st.	1913	Gray Iron & Semi Steel	Automobile & Jobbing	125	Daniel J. Ryan	Fred D. Ryan
American Brass Mfg. Co. 1521 E. 49th		Brass	Jobbing	¾	Anthony Arth	
American Ship Building Co. Ft. of W. 54th	1899	Gray Iron, Brass, Bronze & Aluminum	Marine & General Jobbing	25	W. H. Gerhauser	F. L. Obert
Apex Electrical Mfg. Co. 1067 E. 152nd	1930	Aluminum, Brass & Bronze	Vacuum Cleaner & Mill	2	C. G. Frantz	J. J. Mader
Art In Bronze Co., Inc. 1621 E. 41st.	1919	Nonferrous	Ornamental & Pattern		R. E. Shepherd	Chas. F. Beeler
Arth Brass & Aluminum Casting Co. 1378 E. 33rd	1917	Brass, Bronze, Copper & Aluminum	Jobbing	1½	Mrs. M. Arth	James Reeha
Atlas Foundry Co. W. 69th & W. & L. E. R.R.	1913	Gray Iron & Semisteel	Jobbing	20	B. R. Pearse	Wm. H. Shilling
B. & B. Aluminum Match Plate Co. 4082 Dill Rd.	1927	Brass & Aluminum	Pattern & Match Plate		Edna B. Brown	Gabriel Jobbleagy
Barnes Foundry Co. 4007 Detroit	1921	Brass & Aluminum	Jobbing	1	George Barnes	
Bishop & Babcock Mfg. Co. E. 49th & Hamilton Ave.		Brass, Bronze, Aluminum	Part of Industrial Plant	1½	F. M. Miser	A. H. Reinhard
Bowler Foundry Co. 4255 E. 49th	1862	Gray Iron	Jobbing	15-20	J. H. Bruce	J. L. Simpson
Brookside Brass Foundry & Mfg. Co. 4612 Oak Park	1900	Brass	Plumbing Supplies	½	J. Mueller	J. Erbes
Brost Pattern Works 2934 E. 55th St.	1926	Brass, Bronze & Aluminum	Pattern & Jobbing	2	J. V. Brost	O. W. Brost
Browning Crane Co. E. 162nd & Waterloo Rd.	1900	Gray Iron & Brass	Locomotive Crane	20	Sheldon Cary	H. S. Meyer
Buckeye Brass & Mfg. Co. 6410 Hawthorne St.	1912	Brass & Bronze	Bushings & Bearings	12	L. P. Disinger	Charles Steager
Anthony Carlin Co. 2717 E. 75th	1888	Gray Iron	Jobbing	4	Anthony Carlin M. J. McGuire	A. McGuire
Case School of Applied Science Cleveland, Ohio	1918	Aluminum & Gray Iron	Experimental	1	Prof. J. C. Wattleworth	A. A. McCarvel
Cedar Foundry & Mfg. Co. 2167 E. 55th	1921	Brass & Aluminum	Plumbing & Jobbing	6	F. H. Schoenfeld	J. F. McCaslin
Central Brass Mfg. Co. 2950 E. 55th	1895	Brass	Plumbing Specialties	5	E. A. Eckhouse	Wm. Kelloway
Chandler & Price Co. 6000 Carnegie Ave., S. E.	1912	Gray Iron	Machinery—Part of Industrial Plant	20	R. J. Frackelton	Milo Barrett
Chicago Pneumatic Tool Co. 1241 E. 49th	1902	Bronze, Brass & Aluminum	Pneumatic & Electric Tools	1½	H. A. Jackson	W. E. Lindley
City Foundry Co. 4629 Hamilton Ave., N. E.	1897	Gray Iron & Semisteel	Jobbing	30	Walter D. Sayle	W. Meyer
Cleveland Alloys Co. 2284 Scranton Rd.	1914	Alloy Steels	Jobbing	5	H. E. Gresham	John Pfieffer
Cleveland Aluminum Casting Co. 901 Addison Rd.	1912	Brass, Bronze, Aluminum & Nickel	Jobbing		James W. Tovell	
Cleveland Brass Mfg. Co. 4606 Hamilton Ave.	1892	Brass	Cocks & Valves	2-5	M. F. Barrett L. J. Hengesbach	George Leach
Cleveland Co-Operative Stove Co. Central Ave. & E. 67th	1867	Gray Iron	Stove Plate	150	K. F. Gill J. Mitchell	Homer Britton
Cleveland Steel Casting Co. Hubbard Ave. S. E. near E. 69th	1893	Steel	Jobbing—Gears & Gear Blanks, etc.	25	G. W. Balkwill	R. I. Wiswell
J. A. Cochrane Brass Mfg. Co. 1390 E. 41st	1913	Brass & Copper	Plumbing	4	D. H. Cochrane	J. Wamser
Consolidated Castings Co. Scranton Rd.		Gray Iron, Semi-steel & Chilled Iron	Melting Pots and Jobbing	25	Henry H. Schneider	O. J. Zeman
Crucible Steel Casting Co. Almira Ave. & W. 84th	1911	Carbon & Alloy Steels	Jobbing	15	H. L. Aiken	N. W. Jaenke
Cuyahoga Foundry Co. 4530 E. 71st	1920	Gray Iron and Semisteel	Diesel Engine, Machine Tool	25	James V. Proshek	Charles Wachalec
Eberhard Mfg.Co. 2734 Tennyson Rd.	1880	Malleable Iron		40	George B. Shepard	Walter Quale
Electric Vacuum Cleaner Co. Ivanhoe Rd.	1914	Aluminum	Vacuum Cleaners	4	Julius Tuteur	Anthony Nenec
Empire Brass Mfg. Co. 10301 Berea Rd.	1908	Red Brass	Plumbing Goods	1	L. A. Deutsch	D. A. Leahy
Euclid Foundry Co. Euclid, Ohio	1921	Gray Iron & Semisteel	Machinery	16	N. Berg	M. J. Gilmore
Fanner Mfg. Co. Brookside Park	1894	Malleable & Gray Iron	Stars, Jobbing		J. R. Raible	Patrick McDonne
Farnan Brass Works Co. 1104 Center, N. W.	1852	Brass	Plumbing & Jobbing	½-¾	L. P. Smith Jr.	M. Terill
Favorite Brass Foundry 2539 Central Ave., S. E.	1905	Red & Yellow Brass	Car Box, Gas Fixtures, Patterns	2	George G. Jones	Jas. W. Stegall
Ferro Machine & Foundry Co. 3155 E. 66th Street	1906	Gray Iron	Automotive—Rough & Machined	500	J. F. Leitch C. C. Penrose	Ernest Geible Foldy Baker
Forest City-Walworth Run Foundries Co. 2488 W. 27th Street	1895	Gray Iron & Semisteel	Light Mchy., Agri.; Stove Plate & Furnace	60-75	W. J. Strangward C. F. Seelbach	Frank La Fon James Wilkins Frank Hulec
V. Friedl Foundry Co. 660 E. 163rd Street	1919	Aluminum, Brass & Bronze	Jobbing		V. Friedl	
Fulton Foundry & Machine Co. E. 75th & Morgan Ave.	1917	Gray Iron & Meehanite	Jobbing—Heavy	15	A. C. Denison	F. L. Barton
Glauber Brass Mfg. Co. Platt Ave. & E. 79th	1889	Brass	Plumbing Supplies	2-5	A. E. Trattner	J. Dunn
Globe Brass Mfg. Co. 2925 E. 55th	1907	Red Brass	Plumbers' Goods	1½	H. F. Albers	H. F. Schroeder
Gluntz Brass Foundry Co. 10803 Harvard Ave.	1922	Brass & Aluminum	Jobbing	3-8	Daniel J. Gluntz	John Benedict
Grabler Mfg. Co. 6565 Broadway	1901	Gray Iron, Malleable & Brass	Pipe Fittings	120	M. C. Rosenfeld	D. J. McAboy
Griffin Wheel Co. 6704 Bessemer Ave.	1926	Chilled Iron	Car Wheels	125	F. L. Whitcomb	A. L. Ringo
John Harsch Bronze & Fdy. Co. 11612 Madison Ave.	1918	Nonferrous	Jobbing, Architectural	5-10	H. B. Harsch	H. J. Harsch
Hill Clutch Machine & Fdy. Co. 6400 Breakwater Ave.	1886	Gray Iron & Semisteel	Transmission Machinery	10-20	Ralph Perkins	W. O. Larson
Hines Pattern & Mfg. Co. 10108 Detroit Ave.	1910	Aluminum	Pattern & Jobbing		James F. Hines	Russell J. Hines
Hoffman Bronze & Aluminum Casting Co. 1000 Addison Rd.	1918	Brass, Bronze, Copper & Aluminum	Jobbing	2	Robert S. Hoffman	

Representative Foundries in Cleveland

Name and Address	Established	Metal Melted	Class of Castings	Daily Output in Tons	President or General Mgr.	Foundry Supt.
Holland Trolley Supply Co. 1623 E. 43d Street	1918	Brass, Bronze, Aluminum & Copper	Electrical	10	H. W. Cole	H. M. Hannon
Geo. Horvath Pattern Brass Foundry, 8209 Holton Ave., S. E.		Mang. Bronze, Brass & Aluminum	Jobbing		George Horvath	
H. J. Hunger Brass Works. 1751 E. 27th	1892	Brass & Aluminum	Jobbing	¾	R. H. Hunger	Geo. Adler
International Foundry. 6601 Morgan Ave.	1914	Gray Iron	Jobbing	10	E. Hribal	F. J. Lukes
Johnston & Jennings Co. 877 Addison Rd.		Gray Iron	Jobbing	20	T. J. Calhoun	A. M. Hall
Kayline Fixture Co. 600 Huron Rd.		Brass & Bronze	Chandeliers—Electric Fixtures	¼	B. F. Klein	E. O. Fox
Kilby Mfg. Co. 4623 Lakeside Ave.	1888	Gray Iron & Semisteel	Jobbing	25	C. A. Paine J. H. Francis	Fred Grundie
King Bronze & Aluminum Co. 1734 E. 37th		Brass, Bronze & Aluminum			Geo. Kinkopf	Joe Kinkopf
L. N. N. Foundry Co. 17204 Waterloo Rd.	1925	Gray Iron	Jobbing	10–15	R. M. Katz	Phil Kleinman
Lake City Malleable Co. 5046 Lakeside Ave.	1928	Malleable Iron	Automotive & Jobbing		J. H. Redhead	A. H. Chappelka
Lakewood Engineering Co. Berea Rd. & W. 117th	1917	Gray Iron	Machinery	5	H. A. Baker	Emil Kasper
Leader Brass Fdy. & Mfg. Co. 3301 Jennings Rd.	1913	Brass	Jobbing, Part of Industrial Plant	¾	F. W. Ficht	H. J. Ficht
Madison Foundry Co. 935 Addison Rd., N. E.	1902	Gray Iron & Semisteel	Jobbing	20	M. W. Merriman	James T. Merriman
Mathews Stee' Castings Co. 3311 W. 75	1924	Steel	Jobbing—Medium & Light	20	J. Mathews	
Meech Avenue Foundry. 9906 Meech Ave., S. E.	1921	Gray Iron & Semisteel	Jobbing	8	P. R. Mooren	A. H. Heilman
Monarch Aluminum Ware Co. 9301 Detroit Ave.	1913	Aluminum	Permanent Mold, Cooking Utensils and Machinery Parts		A. S. Deutsch	C. J. Amick
Morgan Bronze, Inc. E. 91st & George Ave.	1920	Bronze Ingots	Jobbing	2–6	H. A. Koester	John Bolden
Nat'l Bronze & Aluminum Foundry Co. E. 88th & Laisy Ave.	1908	Bronze & Aluminum	Jobbing	75	J. H. Shafner	J. H. Schmeller
National Malleable & Steel Castings Co. 10600 Quincy Ave., S. E.	1868	Malleable	Jobbing	75	H. F. Pope Walter Woody	Fred Stewart
New Era Aluminum Co. 3001-3005 E. 55th	1929	Brass & Aluminum	Jobbing	6½	Geo. G. Stickney	Jacob Buchholz
Nickel Plate Foundry Co. 14915 Woodworth Rd.	1919	Gray Iron & Semisteel	Jobbing, Machine Tool	20	C. M. Bolich	H. Staiduhar
Ohio Foundry Co. 2469 E. 71st	1893	Gray Iron	Machine Tool	35–50	W. H. Smith	Henry Longfield Chas. Herbold
Otis Steel Co. 3341 Lakeside Ave.	1873	Steel	Acid, Basic, Electric, Alloy	100	E. J. Kulas	John Gallagher
Parker Appliance Co. 10320 Berea Rd.	1926	Brass & Aluminum Alloy	Pipe Fittings & Valves	2	A. L. Parker	
Parker-Street Castings Co. Garfield Heights	1922	Gray Iron	Automotive, Refrigerator, Aeronautical	25–50	H. R. Street	
Pattern Castings Co. 3740 W. 143rd	1925	Brass, Bronze & Aluminum	Bearings, Jobbing	¾	R. G. Heintz	Charles Cotman
Peck, Stow & Wilcox Co. 2172 W. Third	1884	Gray Iron	Part of Industrial Plant	2½	A. M. Hecht	Wm. Gedecke
Permold Co. 6700 Grant Ave.	1920	Aluminum	Permanent Mold		W. M. Weil	Louis Seaver
Pioneer Alloy Products Co. 16601 Euclid Ave.	1920	Heat Resisting Alloys		1½	Wm. H. Smith	E. F. Hiltz
Progress Foundry & Mfg. Co. 3861 E. 93rd	1922	Aluminum & Brass	Match Plates & Pattern		Frank Haag	Clem Wildenthaler
Proof Machine & Brass Foundry Co. 936 E. 72nd	1917	Brass & Aluminum	Automotive Hardware & Jobbing	4	James Plachy	
Redflex Signal Co. 2675 Pittsburgh Ave.	1928	Aluminum	Jobbing		Eben S. Martin	John J. Kerchinske
Royal Brass Mfg. Co. 1420 E. 43d	1919	Brass	Plumbing	3	S. J. Regan C. U. Brennan	Steve Alamasy
Southern Wheel Co. 2112 W. 106th		Cast Iron & Chilled Iron	Railway Wheels	100	F. C. Turner	A. L. Ringo
Standard Alloy Co. 1679 Collamer Rd.	1928	Nickel-Chromium Alloy	Heat & Corrosion Resisting Alloys	4	Harvey Smith	F. F. Jackson
Standard Brass Fdy. Co. 990 E. 67th	1900	Nonferrous	Jobbing	7–8	A. J. Bloom	F. J. Mental
Sterling Brass Co. 9600 St. Catherine Ave.	1907	Brass	Plumbers' Goods		Sidney L. Weil	John Krieger
Superior Foundry Co. E. 71st & W. & L. E. Ry.	1893	Gray Iron & Semisteel	Jobbing, Automotive	150	George J. Feiss	Charles Jedlika
Taylor & Boggis Foundry Co. 1290 E. 53rd	1865	Gray Iron	Jobbing	45	I. T. Kahn	John Luton
W. S. Tyler Co. Superior Ave. & E. 36th		Brass, Aluminum & Gray Iron	Ornamental and Jobbing	20	Proctor Patterson	R. W. Disbro
United Oberndorf Corp. 3844 Hamilton Ave.	1926	Red & Yellow Brass	Plumbers' Brass Goods		W. J. Oberndorf	Richard Klug
U. S. Aluminum Co. 2210 Harvard Ave.	1909	Aluminum Alloys	Jobbing	30–35	A. B. Norton	R. H. White
U. S. Aluminum Match Plate Co. 1269 W. 76th	1920	Aluminum, Brass & White Metal	Pattern Castings		R. G. Adler	A. Hoffman
U. S. Brass Corp. 1276 E. 55th	1928	Nonferrous	Jobbing	1–3	Robert R. Ivone	
U. S. Pipe & Foundry Co. 1150 E. 26th	1899	Gray Iron	Water Pipe & Fittings	5	N. F. S. Russell A. W. Lewis	Alfred Hibbs
Victor Brass Mfg. Co. 6813 Wade Park Ave.	1912	Brass	Plumbers' Brass Goods		T. J. Moran	
Walleck Brass Foundry Co. 2959 E. 55th	1924	Aluminum & Brass	Electrical Fixtures	1	William M. Walleck	Andrew Yaro
Weiss Brass Fdy. & Mfg. Co. 5027 St. Clair Ave.		Brass, Bronze & Aluminum	Plumbers' Supplies & Jobbing		F. J. Weiss	
Wellman Bronze & Aluminum Co. 6017 Superior Ave.	1910	Brass, Bronze & Aluminum	Jobbing	5–10	F. S. Wellman H. G. Wellman	C. C. Harmon
West Steel Casting Co. 805 E. 70th	1906	Carbon & Alloy Steels	Wheels, Housings, Machine Tool Castings	25	Ralph H. West D. P. Lansdowne	F. C. Pender
Westinghouse Elec. & Mfg. Co. 1216 W. 58th	1898	Gray Iron	Electrical Machinery	50	C. G. Schluederberg	J. H. Johnston
K. L. Wright Brass Foundry. 1359 W. 67th		Brass & Aluminum	Jobbing		K. L. Wright	Walter Wright
Zellner Foundry Co. 2020 Center	1923	Gray Iron & Brass	Machinery	8	Karl Zellner	George McNab



Industry Awaits Opening

Cleveland Committees Prepare Entertainment Features for Visitors at Thirty-Fourth Convention of American Foundrymen's Association

WITH eager expectancy, the foundry industry of the United States and Canada awaits the opening of the doors of Cleveland's public hall on May 12 for the thirty-fourth annual convention of the American Foundrymen's association and the fourth great gathering of this character in Ohio's largest city. With no less intense expectancy, the foundry and allied interests of Cleveland await to extend that cordial hospitality which characterized the entertainment of visitors in 1906, 1916 and 1923. The city is proud of its place as second in the rank of leading foundry centers of North America, as shown in the last roll call of casting plants. Its industry represents practically every branch of metalworking and the modern facilities and methods will be appreciated by those in attendance at the 1930 convention who avail themselves of the opportunities for plant visitation.

Cleveland is noted for the diversity of its products. While it ranks high in the production of textiles, garments, paints and sundry other commodities, basically the metalworking industry is the backbone of the city's commercial and manufacturing prominence. A junction point from which the huge ore shipments of the upper lakes diverge into the valley and Pittsburgh districts naturally has permitted the city to attain this standing in iron and steel. Along the banks of its crooked Cuyahoga will be found huge blast furnaces for the production of pig iron and rolling mills where wire, sheet, plates and other finished steel products find their inception. The industrial character of Cleveland's viewpoint is demonstrated by its interest in and facilities for receiving and handling the convention and exhibition of the American Foundrymen's association.

Unusual facilities are provided for centralizing all of the features of the great exposition, the technical sessions, the educational exhibits and a large portion of the entertainment features. Cleveland's public hall, situated in the commanding center of the city's group of civic buildings, known as the Mall, is an unusual structure. Designed with a view to providing service for great gatherings of the character of the A.F.A. con-

vention, it provides a vast exhibition area of which the foundry show will occupy more than 90,000 square feet, ample meeting rooms for the technical sessions with all the latest mechanical and electrical aids to speaker and audience, restaurants, lounge rooms and theater auditoriums to suit a wide range of requirements. The major activities of the entire week will center in this one structure. It will provide facilities for the registration at the north entrance; the exhibition in the main auditorium, the west exhibition hall annex and the connecting arcade; the meetings in the north assembly rooms with luncheon sessions in the lower halls; and the local reception in the north assembly rooms.

Keen interest is evidenced by foundry equipment and supply manufacturers and more than 250 displays will be offered to the discriminating inspection of those who attend the show. The main auditorium floor of the public hall will be occupied by the nonoperating type of exhibit, while the working machinery will be shown in the west exhibition hall. Conveyors, cranes, molding machines, sand preparation and conditioning equipment, furnaces, core ovens and all the other modern aids to economical castings production will be displayed, many of them performing actual foundry operations. The arcade between the two exhibition halls will be given over to educational exhibits of a noncommercial character, castings of representative and unusual character, the work of A.F.A. committees, technical schools and the trade associations of the foundry industry. The exhibition will be open Monday and Wednesday nights until 10 p.m. and each other day from 10 a.m. until 5 p.m.

Fifteen technical sessions have been arranged for the consideration and discussion of prepared papers. These cover foundry costs, malleable founding, cast iron metallurgy, nonferrous foundry practice, management, sand control, steel founding, apprentice training, materials handling, and melting and coreroom practice. The number of papers at each session has been held to a minimum to permit ample time for free discussion. In addition three roundtable luncheon meetings and a number of shop operation courses will provide a full schedule for the foundryman who attends the convention to learn more about the practical aspects of his business. The work of the active committees of the association will be reviewed by reports at the various technical associations and many of the committees will avail themselves of the opportunity to hold sessions.

Local arrangements for entertaining the visitors have been completed under direction of a committee of foundrymen, equipment and supply representatives. A welcoming reception and party has been arranged for Monday evening, May 12,

at the public hall, starting at 9 p.m. This will be sponsored by the local committee and will be the expression of Cleveland's hospitality to the city's guests. Dancing, cards and varied entertainment features will be offered for the enjoyment of the visitors and a buffet supper will be served.

Shop Courses

Monday, May 12

4:00 p.m.

Gray Iron—Cupola Materials.
Leader: C. J. Scullin, Alda Research Laboratories, Inc., St. Louis, Mo.
Assistant Leader: E. J. Lowry, Detroit.

Tuesday, May 13

4:00 p.m.

Steel—Chipping, Grinding and Riser Removal.
Leader: S. R. Robinson, Industrial Brownhoist Corp., Bay City, Mich.
Gray Iron—Cupola Materials and Operation.
Leader: R. J. MacPherran, Allis Chalmers Mfg. Co., Milwaukee.
Assistant Leader: F. J. Walls, Wilson Foundry & Machine Co., Pontiac, Mich.
Nonferrous—Fuel-fired Furnace Melting.
Leader: E. R. Darby, Federal Mogul Corp., Detroit.

Wednesday, May 14

4:00 p.m.

Steel—Core Room Practice.
Leader: J. M. Sampson, General Electric Co., Schenectady, N. Y.
Assistant Leaders: H. E. Mooney, Falk Corp., Milwaukee, and W. F. Wilson, American Steel Foundries, East Chicago, Ind.
Gray Iron—Gating and Risering.
Leader: H. W. Dietert, U. S. Radiator Corp., Detroit.
Assistant Leaders: E. M. Handley, Chain Belt Co., Milwaukee, and Dr. Fritz Meyer, National Radiator Co., Johnstown, Pa.
Nonferrous—Induction-type Electric Furnace Melting.
Leader: R. W. Parsons, Ohio Brass Co., Mansfield, Ohio.

Thursday, May 15

4:00 p.m.

Steel—Practical Aspects of Heat Treating.
Leader: A. W. Lorenz, Bucyrus-Erie Co., South Milwaukee, Wis.
Assistant Leaders: On Manganese Steel, H. P. Evans, Hubbard Steel Foundry Co., East Chicago, Ind.; On Alloy Steel Castings, D. Zuege, Sivyer Steel Casting Co., Milwaukee; On Fuel Oil Characteristics, A. C. Jones, Lebanon Steel Foundry, Lebanon, Pa.
Gray Iron—High Test Irons, Alloy Additions and Heat Treatment.
Leader: H. Bornstein, Deere & Company, Moline, Ill.
Assistant Leader: F. B. Coyle, International Nickel Co., New York.
Nonferrous—Indirect-arc-type Electric Furnace Operation.
Leader: D. E. Broggi, Neptune Meter Co., Long Island City, N. Y.

In addition to the shop-operation course sessions mentioned on gray iron, C. J. Scullin, assisted by various metallurgists, will hold discussion groups each evening on the fundamentals of cupola operation. These will convene at 8:00 p.m. in the Hotel Statler on Monday, Tuesday, Wednesday, and Thursday evenings.

The local committee in cooperation with the A.F.A. has arranged to make the occasion a happy one for the visiting ladies. A drive through the city and suburban residential and park districts culminating in a luncheon at Shaker Country club will be offered Tuesday. The exhibitors' dinner, given by those who have displays at the exposition, in co-operation with the A.F.A. will be held Tuesday evening, while the annual banquet is the feature of attraction for Thursday night.

One of the outstanding events of the banquet will be the presentation of the Penton gold medal to H. A. Schwartz for his achievements in the foundry industry. The medal will be presented by Mr. Penton, in behalf of the American Foundrymen's association. Miss Genevieve Rowe, Wooster, O., winner of the 1929 Atwater Kent national audition will sing several numbers during the banquet. She will be accompanied at the piano by her father, Prof. Rowe of Wooster college. The speaker of the evening will be Dr. Allen Albert whose subject will be, "The New Economic Revolution."

The local plant visitation committee has arranged for those who desire to visit foundries and other metalworking plants to be admitted to those establishments which are representative of the best modern practice. Detailed plans for plant visitation may be obtained at the local registration headquarters in the lobby of the public hall.

Will Hold Meetings

During the week many meetings of allied organizations will be held. The Gray Iron institute, the Steel Founders' Society of America and the Foundry Equipment Manufacturers' association will take this opportunity to assemble the members in group meetings. In addition many of the firms selling products used in the foundry industry will hold gatherings of their engineering representatives, manufacturing and field men.

Technical sessions to be held at the Cleveland convention will develop a wealth of information of great value to those connected with any phase of the foundry industry. Twenty-six different sessions are scheduled for the convention week including the various shop operation courses. This year the latter have been extended to include courses in nonferrous founding.

The first technical session will be held on Monday, May 12, at 4 p. m. directly following the business meeting. This session will be a shop operation course on gray iron under the leadership of C. J. Scullin, Alda Research Laboratories Inc., St. Louis, and E. J. Lowry, Detroit. The discussion will deal with cupola materials. Tuesday, May 13 will be a full day with eight technical sessions scheduled. Several of these will be held simultaneously. A session on foundry costs will be held at 10 a. m. with papers by J. L. Carter, Sacks-Barlow Foundries Inc., Newark, N. J., and C. W. Humphries, Westco Chippewa Pump Co., Davenport, Iowa. Mr. Carter will describe a cost system for gray iron foundries while Mr. Humphries will discuss the organization of a nonferrous cost group.

A session on malleable founding will be held simultaneously with the cost session at 10 a. m. Three papers to be presented at that time include, "Continuous Melting Process as Applied to Malleable Iron," by B. R. Mayne, General Motors Corp., Saginaw, Mich.; "Factors Affecting Machinability of Malleable Cast Iron," by H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland, and "Some Features of the Pulverized Coal-fired Air-furnace," by E. F. Wilson, Jefferson Union Co., Lockport, N. Y. At 12:15 p. m. a roundtable luncheon on malleable iron founding will be held under the chair-

Convention Time Table

Monday, May 12

12:00 Noon	Exhibition Opens Registration
2:00 p.m.	Business Session
4:00 p.m.	Shop Operation Course (Gray Iron)
8:00 p.m.	Reception by Cleveland committee
10:00 p.m.	Exhibition Closes

Tuesday, May 13

9:00 a.m.	Exhibit Opens
10:00 a.m.	Foundry Costs Malleable Founding
12:15 p.m.	Round Table — Malleable Founding
2:00 p.m.	Gray Iron Metallurgy Nonferrous Founding
4:00 p.m.	Shop Operation Courses (Steel, Gray Iron, and Nonferrous)
5:00 p.m.	Exhibition Closes
7:00 p.m.	Annual Exhibitors Dinner

Wednesday, May 14

9:00 a.m.	Exhibition Opens
10:00 a.m.	Management (Personnel Training) Gray Iron Foundry Practice Nonferrous Founding
2:00 p.m.	Sand Control Management (Market Survey)
4:00 p.m.	Shop Operation Courses (Steel, Gray Iron, and Nonferrous)
7:00 p.m.	Foundry Instructors Dinner
10:00 p.m.	Exhibition Closes

Thursday, May 15

9:00 a.m.	Exhibit Opens
10:00 a.m.	Steel Founding Apprentice Training
12:15 p.m.	Round Table—Steel Founding Round Table — Nonferrous Founding
2:00 p.m.	Gray Iron Metallurgy
4:00 p.m.	Shop Operation Courses (Steel, Gray Iron, and Nonferrous)
5:00 p.m.	Exhibition Closes
7:00 p.m.	Annual Banquet

Friday, May 16

9:00 a.m.	Exhibit Opens
10:00 a.m.	Materials Handling General Shop Practice
5:00 p.m.	Exhibition Closes

Tentative Program of Technical Papers

Monday, May 12

2:00 p.m.—*Opening Business Session*
4:00 p.m.—*Shop Operation Course—Gray Iron*
8:00 p.m.—*Cupola Discussion Course*

Tuesday, May 13

10:00 a.m.—*Foundry Costs*

A Recommended Standard Cost System for Gray-Iron Foundries, by J. L. Carter, Sacks-Barlow Foundries, Inc., Newark, N. J.
Organizing a Nonferrous Foundry Cost Group, by C. W. Humphries, Westco Chippewa Pump Co., Davenport, Iowa.

10:00 a.m.—*Malleable Founding*

Continuous Melting Process as Applied to Malleable Iron, by B. R. Mayne, Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.
Factors Affecting Machinability of Malleable Cast Iron, by H. A. Schwartz, National Malleable & Steel Castings Co., Cleveland.
Some Features of the Pulverized-Coal-Fired Air Furnace, by E. F. Wilson, Jefferson Union Co., Lockport, N. Y.

12:15 p.m.—*Round Table—Malleable Iron Founding*
Chairman—P. C. DEBRUYNE

2:00 p.m.—*Cast Iron—Metallurgy*

Effects on Cast Iron of Prolonged Heating at 800-1100 Degrees Fahr., by R. S. MacPherran and R. H. Krueger, Allis-Chalmers Mfg. Co., Milwaukee.
Blistering Tendency of Some Cast Iron When Enameled, by A. I. Krynitsky and W. H. Harrison, United States bureau of standards, Washington.

2:00 p.m.—*Nonferrous Foundry Practice*

Deep-Etch Test of Brass, by W. F. Graham and L. A. Meisse, Ohio Brass Co., Mansfield, O.
Application of Ingot Metal to Production of Brass and Bronze, by Wm. Romanoff and C. O. Thieme, H. Kramer & Co., Chicago.
Overcoming Alloy-Ingot Troubles in the Brass Foundry, by Wm. S. Paulson, Thos. Paulson & Son, Inc., Brooklyn, N. Y.

4:00 p.m.—*Shop Operation Courses*

Gray Iron Founding
Steel Founding.
Nonferrous Founding.

8:00 p.m.—*Cupola Discussion Course*

Wednesday, May 14

10:00 a.m.—*Management*

Personnel Management, by Dr. Harry Meyer, Frigidaire Corp., Dayton, O.

10:00 a.m.—*Gray Iron Foundry Practice*

Briquetting Cast Iron Borings, by H. Rayner, Dodge Bros. Corp. division, Chrysler Corp., Detroit.
Continuous Melting from Cold Stock of Gray Iron in Electric Furnace, by N. L. Turner, Beach Foundry, Ltd., Ottawa, Ont.
Methods for Determining the Volume Changes Undergone by Metals During Casting, by E. J. Ash, A. F. A. research associate, United States bureau of standards, Washington.

10:00 a.m.—*Nonferrous Founding*

(a) Care and Maintenance of Fuel-Fired Furnace Linings in the Nonferrous Foundry, and
(b) Selection and Use of Refractory-Maintenance Cement in the Nonferrous Foundry, by H. E. White, Lava Crucible Co., Pittsburgh.
Stronger Aluminum Castings by Improved Foundry Practice, by E. M. Gingerich and H. J. Rowe, Aluminum Co. of America, Pittsburgh.
Progress in Die-Casting Industry, by Marc Stern, A C. Spark Plug Co., Flint, Mich.

2:00 p.m.—*Sand Control*

Sand Control as Viewed from the Producers' Standpoint, by W. W. Kerlin, Enterprise Sand Co., Pittsburgh.
Reports of Committees.

2:00 p.m.—*Management*

The Value of Sales Analysis and Market Research, by J. P. Newman, McGraw-Hill Publishing Co., New York.
The Value of Cleanliness and Neatness in a Foundry, by Ed. Trapken, Sandusky, O.

4:00 p.m.—*Shop Operation Courses*

Steel Founding.
Gray Iron Founding.
Nonferrous Founding.

8:00 p.m.—*Cupola Discussion Course*

Thursday, May 15

10:00 a.m.—*Steel Founding*

Reclaiming Steel Foundry Sands, by M. D. Pugh, Illinois Testing Laboratories, Inc., Chicago.
Address by George Batty, Steel Castings Development bureau, Philadelphia.
Australian Steel Foundry, Practice, by D. Clark, Adelaide, Australia. (Submitted on behalf of the Bureau of Steel Manufacturers of Australia.)
Reports of Committees.

10:00 a.m.—*Apprentice Training*

Foundry Apprentice to Apprentice Foreman, by E. H. Ballard, General Electric Co., West Lynn, Mass.
Where are the Young Foundrymen?, by S. W. Utley, Detroit Steel Casting Co., Detroit.

12:15 p.m.—*Round Table—Steel Founding*
Chairman—W. J. CORBETT

12:15 p.m.—*Round Table—Nonferrous Founding*
Chairman—H. M. ST. JOHN

2:00 p.m.—*Gray Iron—Metallurgy*

Carbon and Sulphur in the Cupola—Some Properties of Coke, by James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
Correlation of Tests for Cast Iron, by J. G. Pearce, director, British Cast Iron Research association, Birmingham, England. (Presented as the Annual Exchange Paper of the Institute of British Foundrymen.)

4:00 p.m.—*Shop Operation Courses*

Steel Founding.
Gray Iron Founding.
Nonferrous Founding.

8:00 p.m.—*Cupola Discussion Course*

Friday, May 16

10:00 a.m.—*Materials Handling*

Continuous Core Ovens, by D. B. Hill, Palmer-Bee Co., Detroit.
Materials Handling, by W. M. Booth, Syracuse, N Y.
Reducing Materials Handling Costs in the Jobbing Foundry, by F. C. Campbell, Eastern Corp., New York.

10:00 a.m.—*Melting Furnaces and Core Practice*

Induction Furnaces for Ferrous and Nonferrous Metals, by Manuel Tama, Berlin, Germany.
Value of Analyses and Specifications for Core Oil, by J. A. Gitzen, Lindsay-McMillan Co., Milwaukee.
A Study of Nonferrous Crucible Melting, by H. E. White, Lava Crucible Co. of Pittsburgh.

manship of P. C. DeBruyne, Moline Malleable Iron Co., St. Charles, Ill.

In the afternoon at 2 p. m. two simultaneous sessions on cast iron metallurgy and nonferrous foundry practice will be held. Papers to be presented at the cast iron session are, "Effects of Prolonged Heating at 800 to 1100 degrees Fahr. on Cast Iron," by R. S. MacPherran and R. H. Krueger, Allis-Chalmers Mfg. Co., Milwaukee, and "Blistering Tendency of Some Cast Iron When Enameled," by A. I. Krynitsky and W. H. Harrison, bureau of standards, Washington. Three papers which will be presented at the session on nonferrous foundry practice are, "Deep-Etch Test of Brass," by W. F. Graham and L. A. Meisse, Ohio Brass Co., Mansfield, O.; "Application of Ingot Metal to Production of Brass and Bronze," by William Romanoff and C. O. Thieme, H. Kramer & Co., Chicago, and "Overcoming Alloy-ingot Troubles in the Brass Foundry," by W. S. Paulson, Thos. Paulson & Son Inc., Brooklyn, N. Y.

Shop operation courses will be held at 4 p. m. Tuesday on steel, gray iron and nonferrous practice. The course on steel will deal with grinding, chipping and riser removal and will be under the leadership of S. R. Robinson, Industrial Brownhoist Corp., Bay City, Mich. The gray iron course will include cupola materials and operation and will be under the direction of R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, and F. J. Walls, Wilson Foundry & Machine Co., Pontiac, Mich. The nonferrous session will relate to fuel-fired furnace melting with E. R. Darby, Federal Mogul Corp., Detroit, as leader.

Eight technical sessions will be held on Wednesday, May 14. A session on personnel management under the direction of Dr. Harry Meyer, Frigidaire Corp., Dayton, O., will be held at 10 a. m. A session on gray iron foundry practice also to be held at the same time includes the following papers: "Briquetting Cast Iron Borings," by H. Rayner, Dodge Bros. Corp., Detroit; "Continuous Melting of Gray Iron from Cold Stock in the Electric Furnace," by N. L. Turner, Beach Foundry Ltd., Ottawa, Ont., and "Methods for Determining the Volume Changes Undergone by Metals During Casting," by E. J. Ash, Ameri-

(*Concluded on Page* 219)

Cleveland Foundrymen Entertaining A. F. A.

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D. J. Gluntz, Gluntz Brass Foundry Co.
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H. B. Harsch, John Harsch Bronze Foundry.
J. F. Hines, Hines Pattern & Mfg. Co.
R. S. Hoffman, Hoffman Bronze & Aluminum Casting Co.
Robert Hoierman, Ohio Foundries Association Inc.
J. H. Johnston, Westinghouse Electric & Mfg. Co.
W. O. Larson, Hill Clutch Machine & Foundry Co.
J. F. Leitch, Ferro Machine & Foundry Co.
J. Luton, Taylor & Boggis Foundry Co.
H. L. McKinnon, C. O. Bartlett & Snow Co.
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F. J. Opatrny, Beardsley & Piper Co.
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Werner G. Smith, Werner G. Smith Co.
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M. G. Thomas, City Foundry Co.
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Robert E. Belt, Malleable Iron Research institute.
J. H. Bruce, Bowler Foundry Co.
A. H. Chappelka, Lake City Malleable Co.
M. J. Sweeney, Allyne-Ryan Foundry Co.
Henry J. Trenkamp, Ohio Foundry Co.

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Mrs. Dan M. Avey.
Mrs. C. M. Bolich.
Mrs. A. H. Chappelka.
Mrs. B. D. Fuller.
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C. A. Barnett
S. S. Parsons

Equipment Developments *Will Feature* Great Foundry Show

STARTLING developments in equipment, which will further the mechanization of many foundry operations and at the same time permit closer control of variables entering into foundry practice, are promised for the exhibition of equipment and supplies which will be held in public auditorium, Cleveland, during convention week. In many instances the improvements included in machines of various types represent the work of leading engineers in the equipment industry during the past two years. Since the show in Chicago last year was of a restricted character, much of the larger equipment, which will be shown in Cleveland, has not been on public display since the exhibit in Philadelphia in 1928. During that period, remarkable changes have taken place in design trends.

The Cleveland exhibition will be housed in the large arena of public auditorium, the spacious exhibition hall which was built several years ago as an annex to the auditorium, and the covered arcade connecting the two buildings. Non-operating exhibits will be located in the main arena of the hall and the heavier equipment will be shown in the exhibition hall. The arcade will be devoted to displays of various trade and technical associations pertaining to one or more of the four branches of the industry; exhibits of a large number of technical colleges administering courses in foundry practice; and displays of a number of American Foundrymen's association committees. This feature of the exhibit is being arranged this year on a more elaborate scale than ever before. Descriptions of the exhibits and lists of the hundreds of company representatives who will attend the convention follow:

A

ABRASIVE CO., Philadelphia—High speed grinding with abrasive wheels will be demonstrated on swing frame, floor stand and portable grinders. Both steel and malleable iron castings will be cleaned. The representatives will be: W. A. McMillan, W. H. Sharpe, J. H. Murphy, A. Dobson and I. R. Blair.

ABRASIVE INDUSTRY, Cleveland — This booth will be equipped as a rest room for the entertainment of visitors and the display of business publications and technical books. F. B. Jacobs, E. S. Heck, G. B. Howarth and J. M. Lathrop will be in attendance.

ADAMS CO., Dubuque, Iowa—Jolt squeeze molding machines, snap flasks, slip flasks, steel jackets, steel bands, steel bottom plates, flask trimmings, vibrators and sprue cutters will be shown by this company. Representatives will be Philip Adams, John A. Cameron, John B. Meyer and Wm. J. Spensley.

ADVANCE MILLING CO., Chicago—Samples of the core binder that this company manufactures will feature the exhibit.

AIR REDUCTION SALES CO., New York—An exhibit of tanks of oxygen, acetylene and carbide and apparatus for oxyacetylene welding and cutting will be featured.

AJAX METAL CO., Philadelphia—Brass and bronze ingot metals of all kinds and various types of castings made with these metals will be shown by this company. A portion of the booth will be used by the Ajax Electrothermic Corp., Ajax Park, Trenton, N. J. for the display of induction type furnaces. The Ajax Metal Co. will be represented by G. H. Clamer, Wm. J. Coane, Frank M. Willeson, Zeno D. Barnes, Roger Keeley, William Adams, Henry Geiseke, J. Cecil Brightbill and S. E. McClure. Representatives of the Ajax Electrothermic Corp., will be E. F. Northrup, Dudley Willcox, Robert Blakesly and A. D. Meyer.

ALBANY SAND & SUPPLY CO., Albany, N. Y.—Various grades of molding sands will be shown by this company. Representatives will be Lawrence Murray, M. J. Slater and B. L. Chamberlain.

ALLOYS & PRODUCTS, INC., New York—A variety of metal alloys will be on display at the booth of this company. Representatives will be Henry Hecht, Frank J. McCaul, Gilbert T. Mason, Edward E. Berliner and Charles Vickers.

AMERICAN BRAKE SHOE & FOUNDRY CO., Chicago—White iron annealing pots, plates and stools, miscellaneous white iron and semi-steel castings will be exhibited. The company will be represented by C. P. Wright, V. G. Bates and W. S. Cumming.

AMERICAN ENGINEERING CO., Philadelphia—Quarter-ton, motor driven, monorail electric hoists will be shown. A special exhibit will show the application of monorail electric hoists to foundry practice. The following representatives will be in attendance: J. G. Worker, J. S. Neisser, H. R. Lukens, H. S. Thoenebe, W. E. Weghorst, A. T. Fisher, H. Barney, L. M. Colwell, H. E. Ruhf, C. F. Florandin, H. C. Sturman, F. B. Menwer, S. R. Vanderbeck, H. A. Neft, C. W. Schroeder and C. DeV. Miller.

AMERICAN FOUNDRY EQUIPMENT CO., Mishawaka, Ind.—Sandblast and dust arrester equipment, sand cutting and conditioning machines, flasks and jackets, and core machines will be shown. The company will be represented by Verne E. Minich, John S. Sammons, Hutton H. Haley, J. D. Alexander, C. B. Schneible, R. S. Judah, L. D. Peik, Jerome E. Sweet, E. J. Turnbull, James Rigby, C. L. Benham, F. G. Schultz, L. B. Kerr, A. H. Freeman, Chas. Rose, J. V. Gaebler, C. H. Lungren and R. J. Hutchinson.

AMERICAN GUM PRODUCTS CO., New York—Core binders and cores of various sizes and shapes made with these binders will be exhibited. The company will be represented by Gordon I. Lindsay, B. W. Bullen, T. J. Ryan, T. J. O'Hara and J. A. Smith.

AMERICAN MONORAIL CO., Cleveland—This company will display overhead monorail conveying equipment, cranes, hoists, lifts, scales,

and containers. Representatives will be J. P. Lawrence, L. E. Gaston, Melvin E. Hartzler, F. N. Willyard, H. L. Stettser, and S. J. Woodward.

AMERICAN STEEL ABRASIVES CO., Galion, O.—Steel abrasives, steel shot and grit will feature this exhibit. Paul McConnell will be in charge.

AMERICAN VENT WAX CO., Lockport, N. Y.—Spools of vent wax of various diameters will be displayed by this company.

APEX SMELTING CO., Chicago—This company will show aluminum and its alloys in ingot and shot form, castings made from aluminum alloys, and an aluminum flux. W. A. Singer, Louis Lippa, G. H. Starmann and E. Muller will represent the company.

ARCADE MFG. Co., Freeport, Ill.—Various types of molding machines will be on display at the booth of this company. The exhibit will consist of a heavy duty molding machine, a hand operated molding machine, three different types of jolt squeeze molding machines, a rollover core machine, and a jolter with a duplex air strip. The company will be represented by L. L. Munn, B. C. Trueblood, V. S. Firestone, Mentor Wheat, August Christen, Herman Kasten, R. E. Turnbull, G. D. Wolfley and Maurice Brown.

ASBURY GRAPHITE MILLS, Asbury, N. J. —Graphite, crude and refined, and a special display of grades to meet the needs of any foundry will feature this exhibit. H. M. Riddle, Sr., H. M. Riddle, Jr., Roy S. Kellogg and J. E. Peterson will represent the company.

ATLAS CAR & MFG. CO., Cleveland—A 3-ton storage battery lift truck, turn-tables and miscellaneous foundry cars will be displayed. F. D. Wright, R. S. Richards and F. A. Williams Jr. will represent the company..

AUSTIN CO., Cleveland—Photographic enlargements and plans of several large automotive and tractor foundries which this company has built, will feature the exhibit. N. L. Palmer, L. E. Conney, A. H. Meyer, H. E. Eiber, G. A. Metzger and W. G. Paton will be at the booth.

AUTOMATIC TRANSPORTATION CO., INC., Buffalo—Two storage battery industrial trucks will be exhibited. One will be a spur gear drive elevating platform type and the other a spur gear drive tier lifting truck. George Hush Jr., Malcolm Nesbit and R. J. Mulholland will be in charge.

AYERS MINERAL CO., Zanesville, O.—Molding sands for iron, steel, brass and aluminum, silica wash, filter sand and glass sand will be shown. The company will be represented by E. M. Ayers, R. G. Hay, J. A. Crew, Lon Kimball and David Davies.

B

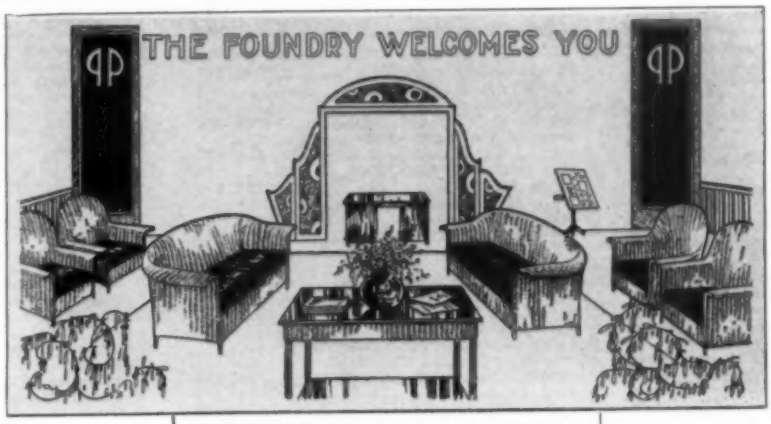
BAKER-RAULANG CO., Cleveland—A three-ton elevating truck and a three-ton lift truck, both battery driven, will feature this exhibit. A. J. Gates, B. C. Hooper, C. H. Warren, E. I. Walsh, G. E. Guy, C. H. Remoe, E. H. Remoe, B. F. Stoner, H. C. Schultz, E. W. Sankey and E. J. Bartlett will be in charge.

C. O. BARTLETT & SNOW CO., Cleveland —This company will exhibit a sand handling installation for feeding sand to two molding machines. Photographs of installations of equipment also will be shown. The company will be represented by H. S. Hersey, H. L. McKinnon, M. E. First, H. C. Orr, W. J. Fruechtel and Oliver S. Kelly.

H. L. BAUMGARDNER MFG. CORP., Fremont, O.—A line of slip flasks with cast iron and aluminum jackets will be exhibited. The company will be represented by H. L. Baumgardner, J. B. Skelly, C. W. Yeager, O. Coe, T. Gassman, F. S. Mangan and J. M. Morrow.

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y.—Metallographic microscopes, wide field and binocular microscopes, optical measuring instruments for industries and magnifiers and reading glasses will be shown at the booth of this company. The representatives will be I. L. Nixon, M. H. Stevens, T. L. Bourne and H. L. Shippy.

BEARDSLEY & PIPER CO., Chicago—Installation photographs of sandslinging machines and sand handling equipment will be exhibited by this company. The following will be in attendance: George Furman, E. O. Beardsley, W. F. Piper, E. O'Connor, E. L. Mitchell, A. V. Magnuson, Frank J. Opatrny, H. G. Schlichter, Robert R. Snow, Harold Lind, A. L. Miller, Peter Stefan, W. E. Naylor and N. W. Stratford.



DIRECTLY at the left of the main entrance to the arcade connecting the main arena with the west exhibition hall is the space occupied by The Foundry and associated papers of the Penton Publishing Co. In this area, booths 96, 98 and 100, visitors to the exhibition are cordially invited to meet their friends, to use all the facilities offered and to rest in the comfortable lounge furniture, after the strenuous round of inspecting the exhibits.

BETHLEHEM STEEL CO., INC., Bethlehem, Pa.—Castings, samples of pig iron, fractures and sections of an alloy pig iron, small tools and tool steel will be shown. The company will be represented by D. A. Barkley, R. H. Lee, F. E. Fisher, W. B. Pritchard, W. S. Lippincott, G. A. Cushman, F. Huffman, H. Hibshman, J. F. Gaffney, Walter Flood, G. F. Simpson and A. D. Smith Jr.

BIAX FLEXIBLE SHAFT CO., INC., New York—Flexible shafts, flexible shaft machinery, die sinking machines, rotary files, track grinders, tools and accessories will be on display. R. Wezel, G. M. VanderBeek, F. I. VanderBeek, H. T. Stroh and K. Vought will be in attendance.

BLACK & DECKER MFG. CO., Towson, Md. —This company will exhibit a pedestal type grinder, a wide type grinder, a tool grinder, normal and high speed production grinders, normal and high speed swing frame grinders, constant cuting speed production and swing frame grinders, portable grinders and sanders, portable electric drills and portable electric saws. The following will be in attendance: W. C. Allen, T. H. Belling, C. C. Watts, R. F. Mitten, J. T. McQuillin, R. E. Mizener, J. A. Fairfield, H B. Mecaslin, Guy Coffey, Luke Boyd, and William Fenwick.

BLAW-KNOX CO., Pittsburgh—Single line, foundry type clamshell buckets, and small models of other type clamshell buckets, together with forged steel gratings and floorguards, will feature the exhibit of this company. The company will be represented by W. W. Cochrane and H. B. Fuller.

BLYSTONE MFG. CO., Cambridge Springs, Pa.—This company will feature a direct motor drive sand mixing machine equipped with a screen.

BOX CRANE & HOIST CORP., Philadelphia—Electric traveling cranes, and electric hoists will be featured at the booth of this company. G. A. Mitchell, R. A. S. Johnson, J. F. Bruce and G. P. Coulter will be in charge.

BRADLEY WASH FOUNTAIN CO., Milwaukee—The display of this company will feature washroom equipment. Representatives will be H. P. Seidel, H. L. Walters, H. A. Mullett and G. D. Coon.

BRITISH ALUMINUM CO., LTD., New York—Aluminum, ingots, virgin and alloys, and castings made in sand, permanent moulds, and dies will be on display. The company will be represented by Arthur Seligman, Arthur Jellinek and A. J. Field.

BUCKEYE PORTABLE TOOL CO., Dayton, O.—A line of pneumatic tools especially adapted to the foundry industry will be shown by this company. The display also will include a new type of drill, with a portable and adjustable pedestal drill stand and a new sander and cup wheel grinder with governor controlled rotor. The company will be represented by W. W. Price, W. R. Gummere, H. O. Gummere and C. F. Overly.

BUCKEYE PRODUCTS CO., Cincinnati—Parting, high temperature furnace cement, core oil, flask pins, core compound and core paste will be featured at the exhibit of this company. Samples of buffing compositions also will be shown. The display will be in charge of Arthur Hoffheimer, Charles Wise and A. J. Laforet.

C

CAMPBELL-HAUSFELD CO., Harrison, O.—This company will show metal melting furnaces for gas or oil fuel including tilting type crucible furnace, and a stationary crucible type furnace for melting brass, bronze and aluminum. J. S. Armour and E. B. Hausfeld will be in charge.

CARBORUNDUM CO., Niagara Falls, N. Y. —This company will display a complete line of abrasive and refractory products. Representatives will be S. F. Courter, G. W. Chormann, B. H. Work, H. E. Kerwin, O. C. Dobson, R. Rainnie and J. C. Rice.

CARBORUNDUM CO., Perth Amboy, N. J.—The display of this company will consist of refractory brick, shapes and high temperature cements. A special feature of the exhibit will be a model of a recuperator air furnace mounted on a base consisting of special recuperator tubes assembled complete with corebusters and terminal wall blocks. The following representatives of the company will be in attendance: S. A. Fenno, W. H. Fitch, R. A. Barr and W. C. Thiess.

CHAIN BELT CO, Milwaukee—Photographs and plans of foundry equipment including sand-handling and conditioning units, mold and casting conveyors, etc., will be shown.

CHAMPION FOUNDRY & MACHINE CO., Chicago—Electric sand riddles, both floor and suspended types, jolt rollover core machines, hand, rollover, molding and core machines and stripping plate machines will be shown. H. O. Magnuson will be in charge.

FRANK D. CHASE, INC., Chicago—Pictures and plans showing the design and construction of foundries and various kinds of buildings will be on display. The company will be represented by Frank D. Chase, Harold Ambler and J. N. Richardson.

CHATEAUGAY ORE & IRON CO., New York—Machine cast, copper free, low phosphorus pig iron, low phosphorus concentrates and sintered iron ore will be shown. J. R. Linney, E. J. Burnes, M. Prosser and C. Kaiser will be in charge of the booth.

CHICAGO CRUCIBLE CO., Chicago—The display of this company will feature graphite crucibles.

CHISHOLM-MOORE HOIST CORP., Tonawanda, N. Y.—Hand power and electric type chain hoists; electric, wire rope hoists; I-beam

Many Companies Will Exhibit Equipment

A

Abrasive Co. 373, 374
Abrasive Industry 96, 98, 100
Adams Co. 445
Advance Milling Co. 75
Air Reduction Sales Co....401, 402, 403
Ajax Electrothermic Corp.... 201
Ajax Metal Co. ....201 to 206
Albany Sand & Supply Co. 64
Alloys & Products Inc. 14
American Brake Shoe & Foundry Co. 59
American Engineering Co. 477
American Foundry Equipment Co.... Block I, 552
American Gum Products Co. 91
American MonoRail Co....261, 263, 265
American Steel Abrasives Co. 411
Apex Smelting Co. 23
Arcade Mfg. Co. 257, 259
Asbury Graphite Mills 439
Atlas Car & Mfg. Co. 313, 315
Austin Co. 30
Automatic Transportation Co. Inc. 482, 484
Ayers Mineral Co. 5

B

Baker-Raulang Co. 444
C. O. Bartlett & Snow Co. 306, 308, 310
H. L. Baumgardner Mfg. Corp.....493, 495
Bausch & Lomb Optical Co. 94
Beardsley & Piper Co. 44
Bethlehem Steel Co. 2, 29
Biax Flexible Shaft Co. Inc. 440, 442
Black & Decker Mfg. Co. .....535 to 543
Blaw-Knox Co. 11
Blystone Mfg. Co. 538
Box Crane & Hoist Corp. 251, 253
Bradley Wash Fountain Co. 231
British Aluminum Co. Ltd. 62
Buckeye Portable Tool Co. 501
Buckeye Products Co. 502
Bullard-Davis, Inc. 79

C

Campbell-Hausfeld Co. 497
Carborundum Co. 476, 478
Carborundum Co., Refractory Div..... 480
Chain Belt Co. 529, 530
Champion Foundry & Machine Co..... 415
Frank D. Chase, Inc. 34
Chateaugay Ore & Iron Co. 48
Chicago Crucible Co. 60
Chisholm-Moore Hoist Corp. 542, 544
Clark Tructractor Co..... 560
Clearfield Machine Co. 486, 488
Cleveland Crane & Engineering Co..... 309
Cleveland Electric Tramrail Div..... 352, 353, 354, 355
Cleveland Flux Co. 19
Cleveland Wire Spring Co. 413
Clipper Belt Lacer Co. 15
Combined Supply & Equipment Co..... 101
Corn Products Refining Co. 61
J. L. Cummings Co. 540

D

Daily Metal Trade 96, 98, 100
Dayton Oil Co. 33
Dayton Pneumatic Tool Corp. 414
Deister Concentrator Co. 550
Wm. Demmler & Bros..... 447
Detroit Electric Furnace Co. 241
Harry W. Dietert 430, 432
Joseph Dixon Crucible Co. 290
J. E. Dockendorff & Co. Inc. 22
Drying Systems, Inc. 404

E

Eastern Clay Products Inc. 92
D. A. Ebinger Sanitary Mfg. Co..... 108
Electric Storage Battery Co. 454
Electro-Chemical Pattern & Mfg. Co..... 66
Electro Refractories Corp..... 83
El-Roy Sand Conditioner 238, 239

F

Fanner Mfg. Co. 81
Federal Foundry Supply Co. 39, 41
Ferro Enamel Supply Co. 53
THE FOUNDRY 96, 98, 100
Foundry Equipment Co. 216, 217, 218
Fowler & Union Horse Nail Co. Inc..... 18
Cyril A. Fox ....226 to 230
General Electric Co. 532, 533
General Electric X-Ray Corp. 82
Globe Steel Abrasive Co. 546
Great Lakes Foundry Sand Co. 93
Great Western Mfg. Co. 449

G

Griffin Engineering Co. 52
Grindle Fuel Equipment Co. 304

H

Harnischfeger Corp. 243, 245
Harrington Co. 358
R. G. Haskins Co. 412
Hayward Co. 289, 291
Herman Pneumatic Machine Co..... 312, 314, 316
Hill & Griffith Co. 16
Hines Mfg. Co. 493, 495
Hisey-Wolf Machine Co. 417, 418
Holcroft & Co. 12
Houghland & Hardy, Inc. 10

I

Illinois Clay Products Co. 63
Illinois Testing Laboratories, Inc. 100
Industrial Minerals Co. 4
Industrial Silica Corp. 46
International Molding Machine Co..... ....281, 283, 285, 287
International Nickel Co. Inc. 104, 106
Iron Trade Review 96, 98, 100
Ironton Fire Brick Co. 28

J

Johnston & Jennings Co. 446
W. A. Jones Foundry & Machine Co. 460, 461, 462, 463

K

Chas. C. Kawin Co. 73
Keener Sand & Clay Co. 47
Spencer Kellogg & Sons Sales Corp. 70, 95
Kelly Graphite Mills, Inc. 553, 554
Kindt-Collins Co. 491
Kling Bros. Engineering Works..226 to 230
Knefler-Bates Co. 49
H. W. Knight & Son 51
H. Kramer & Co. 42
Chas. A. Krause Milling Co..... 38

L

Lava Crucible Co. of Pittsburgh..... 72
Linde Air Products Co. 555, 556
Lindsay-McMillan Co..... 56
Link-Belt Co. 256, 258
Louden Machinery Co. 250, 252, 254
Lowe Mfg. Co. 527

Mc

McCloud River Lumber Co. 409, 410
J. S. McCormick Co. 534, 536, 538
R. W. McIlvaine Co. 438

M

Machine Design 96, 98, 100
Macleod Co 483, 485
Paul Maehler Co. 375, 376
Mall Tool Co. 498
Malleable Iron Fittings Co. 481
Manhattan Rubber Mfg. Division..226 to 230
Marschke Mfg. Co. .....535 to 543
Mathews Conveyor Co. 318
Michigan Screw Co..... 456
Michigan Smelting & Refining Co..... 54
H. E. Mills Mfg. Co. 76
Milwaukee Electric Crane & Hoist Corp. 243, 245
Milwaukee Foundry Equipment Co...223,224
Modern Pouring Device Co. 487, 489
Moline Iron Works 450
Moltrup Steel Products Co. 1
Monarch Engineering & Mfg. Co....292, 294
Mt. Jewett Fire Clay Co. 452

N

National Engineering Co. .....280 to 288
National Smelting Co. 78
Newaygo Engineering Co. 529, 530
New Haven Sand Blast Co. 490, 492, 494
New Jersey Silica Sand Co. 71
Niagara Falls Smelting & Refining Corp. 84
Wm. H. Nicholls Co. Inc. 260, 262, 264
North American Refractories Co..... 107
Northern Engineering Works 428
Norton Co. 211, 212, 213, 214

O

S. Obermayer Co. 255
Oiless Core Binder Co. 496
Oliver Machinery Co. .....240 to 248
Osborn Mfg. Co. .....330 to 339 inc. & 367 to 369

P

Palmer-Bee Co. 545
Pangborn Corp. .....320 to 327 inc.
Patch-Wegner Co. Inc. 433
Peerless Sand Co. 43
Pennsylvania Lubricating Co. 80
Penton Publishing Co. 96, 98, 100
George F. Pettinos 32
Pickands, Brown & Co. 69
Pittsburgh Electric Furnace Corp....328, 329
Precision Grinding Wheel Co. 311
Productive Equipment Corp..... 557

R

N. Ransohoff, Inc. 458, 459
Reading Chain & Block Corp. 551
Reeder Mfg. Co. 435
Robbins & Myers, Inc. 500
Robeson Process Co. 91
Rogers Brown & Crocker Bros. Inc..... 86, 88, 90
Rotor Air Tool Co. 405, 406
Royer Foundry & Machine Co.....360 to 363
John Royle & Sons 526
Ruemelin Mfg. Co. 235

S

Safety Clothing Co. 79
Safety Equipment Service Co. 99
Safety First Shoe Co. 100
Safety Grinding Wheel & Machine Co. 364, 365, 366
Sand Products Corp. 20
Semet-Solvay Co. 77
Shepard Niles Crane & Hoist Corp. .....382 to 385
W. W. Sly Mfg. Co. .....340 to 351 inc.
Eugene W. Smith Inc. 25
Smith Facing & Supply Co. 31
Smith-Monroe Co. 540
Smith Oil & Refining Co. 103
Werner G. Smith Co. 40, 65
Spencer Turbine Co. 247, 249
Standard Conveyor Co. 234
Standard Safety Equipment Co. 441
Standard Silica Co. 6
Steelblast Abrasives Co. 437
Sterling Wheelbarrow Co. 57
Frederic B. Stevens, Inc. 55
Stone Pattern Mount Co. 87
Stoney Foundry Engineering & Equipment Co. 293, 295
Superior Sand Co. 74

T

Tabor Mfg. Co. 379, 380, 381
Warner R. Thompson Co. 45
Tiona Petroleum Co. 85
Tottenville Copper Co. Inc. 27
Truscon Steel Co. 558, 559
Tuscora Sand & Coal Co. 21
W. S. Tyler Co. 407, 408

U

United Compound Co. 97
U. S. Electrical Tool Co.....451 to 457
U. S. Graphite Co. 89
Universal Sand Equipment Co.....219 to 222

V

Van Dorn Electric Tool Co.....535 to 543
Vesuvius Crucible Co..... 436

W

Wadsworth Core Machine & Equipment Co. 429
J. D. Wallace & Co. 207, 208
Jervis B. Webb Co. .....460 to 463 inc.
Westinghouse Traction Brake Co. 370, 371, 372
White Bros. Smelting Corp. 8
White Rock Silica Co. 26
Whitehead Brothers Co. 7, 9
Whiting Corp. .....Block K
Wilbraham-Green Division 307
G. H. Williams Co. 36
E. J. Woodison Co. 24
T. B. Wood's Sons Co. 35
Wright Mfg. Co. 317, 319

Y

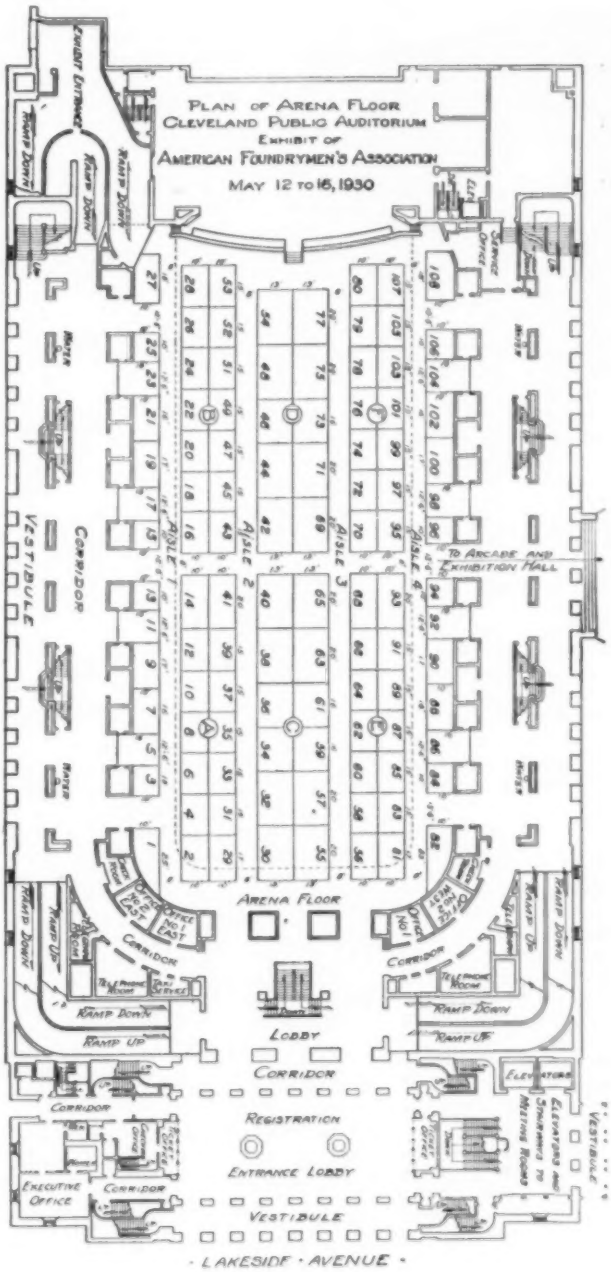
Yale & Towne Mfg. Co. 309, 310
Young Brothers Co. 225

Z

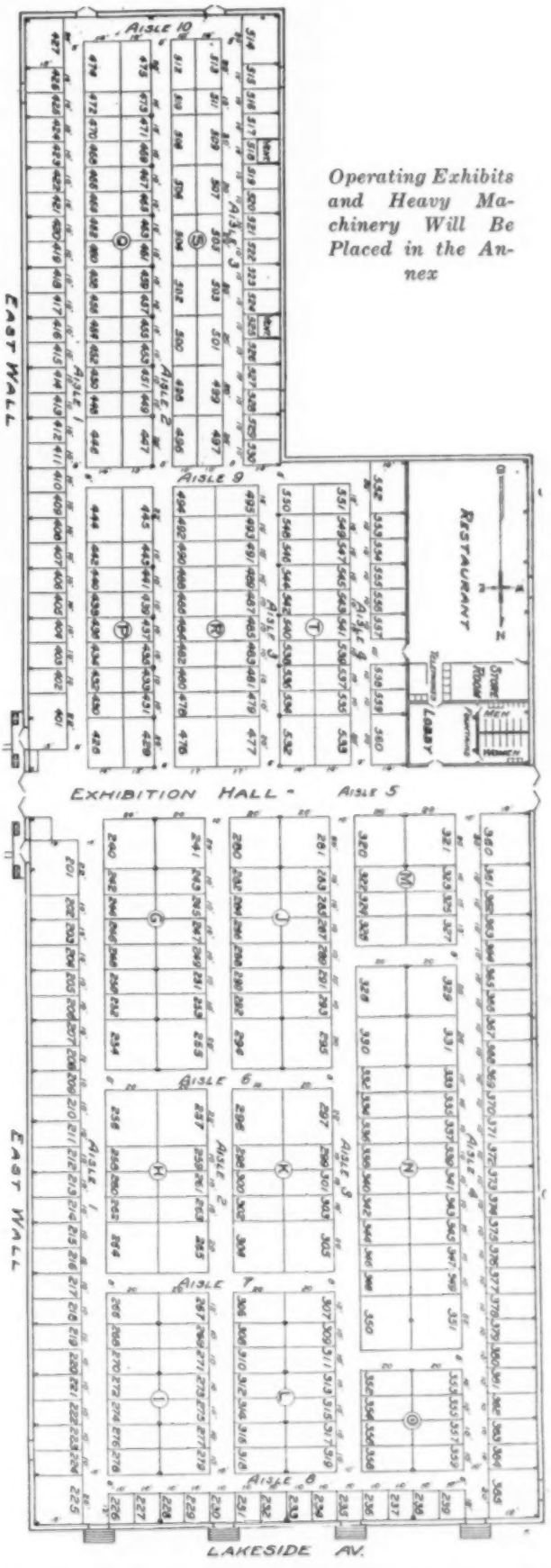
Zanesville Sand Co. 58

Floor Plan of Exhibit Space

in Arena and Exhibition Hall



Nonoperating Exhibits Will Be Displayed in the Arena of the Main Auditorium



Operating Exhibits and Heavy Machinery Will Be Placed in the Annex

trolleys; and cupola charging machines will be featured at the exhibit. The company will be represented by F. W. Shaw, W. H. Morgan, E. N. Turner, A. S. Remsberg and D. S. Brisbin.

CLARK TRUCTRACTOR CO., Battle Creek, Mich.—A gas propelled oven-charger, a gas propelled digger and an automatic end dump tractor with 30 cubic foot body will be demonstrated. C. E. Staninger, Everett M. Sharp, R. J. Burrows and C. I. Ucker will be in attendance.

CLEARFIELD MACHINE CO., Clearfield, Pa.—An operating exhibit of a sand mixer and a sand loader will be shown by this company. W. E. McMurray, J. M. Gallaher, Paul Reece, T. E. O'Donnell and P. B. Reed will represent the company.

CLEVELAND ELECTRIC TRAMRAIL DIVISION, CLEVELAND CRANE & ENGINEERING CO., Wickliffe, O.—Overhead pouring devices, sand handling equipment and other apparatus for overhead handling of material will be exhibited by this company. Various pieces of equipment will be in operation. E. T. Bennington, A. F. Anjeskey, J. R. Bocher, K. R. Weise, A. F. Carl, M. G. Rosenthal, Robert G. Birkin, A. E. Creasy, J. T. Lewis Jr., Harry Haggett, C. A. Blake and J. B. Forker will be in charge of the exhibit.

CLEVELAND FLUX CO., Cleveland—A display of parting compounds and fluxes for brass, bronze, aluminum, iron and semi-steel will be featured. Representatives will be Kirke H. Baum, Clifford B. Cornell, S. E. Moss, J. A. Maxwell and Charles T. Wittich.

CLEVELAND WIRE SPRING CO., Cleveland—Steel tote boxes and barrels for handling castings and similar products as well as steel shelving for storing cores, dies and other materials used in the foundry will be on display at the booth of this company. The display will be in charge of R. J. Poole and A. T. Soden.

CLIPPER BELT LACER CO., Grand Rapids, Mich.—Belt lacing equipment such as lacers, hooks, cutters and connecting pins will be included in the exhibit. Wylie K. Lee and Earl H. Forsyth will be in charge.

COMBINED SUPPLY & EQUIPMENT CO. INC., Buffalo—A paster, chaplets and cast aluminum pattern plates will be displayed. Stephen LeViness Jr. and Everett LeViness will be in charge.

CORN PRODUCTS REFINING CO., New York—This company will exhibit the various types of corebinders which it manufactures and also will show cores made with its line of cereal binders. The representatives at the convention will be: Frank G. Faller, Harry A. Crown, Albert H. Kreischer, Peter J. Dapkus, Joseph M. Millikan, William T. Maguire, Herman C. Knubbe, and James W. Dougherty.

JOHN L. CUMMINGS CO., St. Joseph, Mich.—Special refractories for the gray iron, brass, steel and aluminum foundry practice will be shown. J. L. Cummings and S. L. Davis will be in charge.

D

DAILY METAL TRADE, Cleveland — This booth will be equipped as a rest room for the entertainment of visitors and the display of business publications and technical books. Representatives will be Walter S. Doxsey, William M. Rooney and H. N. Pickett.

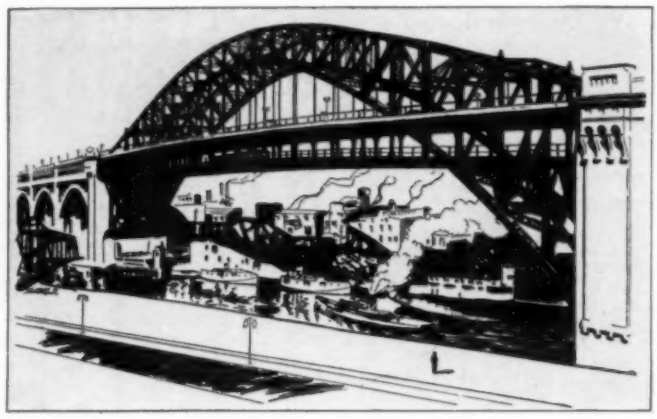
DAYTON OIL CO., Dayton, O.—Core oils and samples of cores made with the various types of oils made by this company will be shown. D. S. Hopping, George A. Storer, S. N. Dykstra, W. C. Clark, E. R. Gilbert, F. Gomersal, J. J. Carr and E. W. Strong will be in attendance.

DAYTON PNEUMATIC TOOL CORP., Dayton, O.—Sand rammers, chippers, riveters, chisel blanks and hose connections will feature this exhibit. E. C. George and H. W. Leighton will be at the booth.

DEISTER CONCENTRATOR CO., Fort Wayne, Ind.—A mobile type grizzley equipped foundry screen, screen combined with a sand blender and slinger and a screen combined with a sand mixer or muller will be shown. Don A. Weber, C. W. Fugate, J. J. Welch and Raymond Green will be at the booth.

WM. DEMMLER & BROS., Kewanee, Ill.—This exhibit will feature core blowing machines in operation. H. L. Demmler, J. N. Dummler, F. A. Demmler and Charles Eshelman will be in charge.

DETROIT ELECTRIC FURNACE CO., Detroit—A rocking type electric furnace of 740 to 1000 pounds capacity in operation and



brass, bronze, gray iron and nickel alloy castings manufactured from metal melted in the electric furnace will be exhibited. E. L. Crosby, A. E. Rhoads, L. T. Crosby, L. C. Wilson, G. R. Jackson, C. H. Morken and M. J. Crowley will represent the company.

DEWALT PRODUCTS CO., Leola, Pa.—Woodworking machinery will be featured in the exhibit of this company.

HARRY W. DIETERT, Detroit—A line of sand testing and sand control equipment suitable for research and foundry control of sands, cores and molds will feature this exhibit. The company will also have a testing machine for each A. F. A. sand testing method, and a number of testing machines which have been developed recently. All machines will be in operation. The company will be represented by Harry W. Dietert, Jack Goldstein, Charles Seman, and Herman Cooper.

JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.—Graphite crucibles, stoppers, nozzles, sleeves, clay refractory nozzles, combination nozzles, clay refractory sleeves, assay sand crucibles and refractories, graphite facings and core washes will be displayed. R. R. Belleville, R. F. Leonard, J. E. Thomas, F. R. Brandon, P. H. Griffin and H. Eichwald will represent the company.

J. E. DOCKENDORFF & CO., INC., New York—Aluminum ingots and castings made from that material will be shown. Whitney S. Hamnett will be in charge.

DRYING SYSTEMS, INC., Chicago—Core, mold, japanning and enameling ovens, indirect heating equipment for industrial ovens, rod baking and low temperature heat treating ovens will be shown. Representatives are C. H. Currier, R. E. Lippert, T. E. Humphrey, B. B. Russell and H. Kolben, Jr.

E

EASTERN CLAY PRODUCTS, INC., Buffalo—The display of this company will feature samples of western clay bond and a new super bond for molding sands. The company will be represented by S. H. Cleland, R. L. Cleland, E. B. Norris, R. C. Halliday, N. J. Dunbeck, W. H. Riker and J. Erler.

D. A. EBINGER SANITARY MFG. CO., Columbus, O.—Sanitary toilet and wash room equipment will be included in the exhibit. The company will be represented by H. H. Leukart, A. G. Peterson, A. E. Smith and R. H. Evans.

ELECTRIC STORAGE BATTERY CO., Philadelphia—This company will display batteries for electric industrial trucks, tractors and locomotives. H. F. Sauer, W. M. Ely, G. V. Cripps, W. V. Mussen, W. G. Chaney and E. C. Kline will be in charge of the booth.

ELECTRO-CHEMICAL PATTERN & MFG. CO., Detroit—This display will feature a complete line of copper pattern equipment made by electro-deposition from single shrink working patterns. The company will be represented by Arthur K. Laukel and John H. Laukel.

ELECTRO REFRACTORIES CORP., Buffalo—Crucibles and special refractories especially applicable to the foundry industry will be featured in a display in charge of L. U. Milward and T. W. Campbell.

ELROY SAND CONDITIONER, Wilkes-Barre, Pa.—A sand conditioner in operation treating foundry sand will be a feature of the exhibit of this company. R. J. O'Donnell and E. S. Royer will be in charge of the display.

F

FANNER MFG. CO., Cleveland—Foundry chaplets, tumbling stars, core wires, flask trimmings, gaggers, nailing plates and core plates will be shown by this company. The display will be in charge of J. R. Raible, C. G. Raible, J. Y. Brooks, S. H. Gibson, P. D. McDonnell, C. E. Ireland, E. Schane, F. W. Beck and J. E. O'Brien.

FEDERAL FOUNDRY SUPPLY CO., Cleveland—This company will display its line of sand testing equipment and will show a number of castings made with its facings, supplies and other products. The company also will demonstrate the rebonding of burned refuse sand. The following will be in attendance: Ralph Ditty, L. H. Heyl, Elmer Ditty, T. H. Terry, W. F. Haggman, G. E. Snedecker, George H. Donoghue, G. A. Fuller, O. E. Peterson, Walter Gerlinger, Harry Donald and T. J. Brown.

FERRO ENAMEL SUPPLY CO., Cleveland—This company will show a continuous motion picture film illustrating enameling equipment installed at the plants of the Mullins Body Corp., Salem, O., Canton Stamping & Enameling Co., Canton., and Florence Stove Co., Leonard division, Kankakee, Ill. Paul V. Blackburn, D. L. Cable and R. A. Weaver will be in attendance.

THE FOUNDRY, Cleveland—This booth will be equipped as a rest room for the entertainment of visitors and the display of business publications and technical books. Representatives will be as follows: Dan M. Avey, Frank G. Steinebach, Patrick Dwyer, Edwin Bremer, Norman F. Hindle, Charles Vickers, J. D. Pease, J. M. Lathrop, A. L. Klingerman, George B. Howarth, C. A. Wardley, S. H. Jasper, John W. Close and Fay Crabs.

THE FOUNDRY EQUIPMENT CO., Cleveland—This company will show a rolling drawer oven, transrack oven, vertical conveyor type core oven, and portable ovens. Photographs showing recent installations also will be on display. The company will be represented by C. A. Barnett, O. D. Conover, C. F. Mayer, H. W. Steindorf, C. J. Pimsner, M. A. Beltaire, E. J. Welter and C. M. Holcomb.

FOWLER & UNION HORSE NAIL CO., Buffalo—This company will show foundry nails. Charles A. Reamer will be in charge.

CYRIL A. FOX, Pittsburgh—Swing frame grinding machines and heavy duty stand grinders of high speed type will feature the

exhibit. Representatives will be Cyril A. Fox, Roy Simonson, Arthur Mennell, Joseph Shull and H. S. Stockdale.

G

GENERAL ELECTRIC CO., Schenectady, N. Y.—This company will exhibit welding equipment, motors and control equipment, and cupola blowers equipped with an automatic device to insure constant weight of air in the cupola. Representatives will be H. V. Crawford and T. H. Reeves.

GENERAL ELECTRIC X-RAY CORP., Chicago—X-ray examinations of castings will be featured in this booth. E. W. Page will be in charge.

THE GLOBE STEEL ABRASIVE CO., Mansfield, O.—Samples of steel shot and grit and the castings showing the different finishes that may be secured with these materials will feature the display of this company. The exhibit will be in charge of C. H. McConnell.

GREAT LAKES FOUNDRY SAND CO., Detroit—Samples of a complete line of foundry sands will be shown by this company. The following will be in attendance: William J. Muhlitner, John D. Cronenweth, Neil I. McArthur, James G. Mendenhall, H. P. Mackinnon, Mason B. Giberson, Sr., Earl L. Smitherman, Edward J. Gutsche, Phil E. Giberson, Henry J. Piehl, H. M. Lane and Y. A. Dyer.

GREAT WESTERN MFG. CO., Leavenworth, Kans. — Gyratory foundry riddles of various sizes for riddling foundry sand will be shown by this company.

GRIFFIN ENGINEERING CO., Chicago—Blue prints, charts and photographs of installations of hot blast cupolas will be exhibited by this company. J. W. Hurley and J. J. Boland will be in charge.

GRINDLE FUEL EQUIPMENT CO., Harvey, Ill.—This display will feature a unit pulverizer complete with feeder, blower, piping and pulverized coal burner. The company will be represented by W. R. Bean, M. F. Becker, C. R. Taylor, R. J. Bender, J. E. Charles and E. H. Nielsen.

H

HARNISCHFEGER SALES CORP., Milwaukee—Working model of a 10-ton crawling traction crane and motion pictures of cupola charging crane will be displayed. The company will be represented by W. Harnischfeger, E. Standfuss, N. P. Farrar, H. H. Erkelenz, A. J. Dreyer, Charles Siegle, A. F. Genthe, F. Liebich and R. J. Wadd.

HARRINGTON CO., Philadelphia — Chain, screw, differential and electric hoists, steel plate ball bearing trolleys, manually-operated traveling cranes, oven-head track, switches, turntables and hoist equipment will be exhibited. Representatives are R. E. Bishop, I. E. Bauer, and C. K. Kelly.

R. G. HASKINS CO., Chicago—This company will show flexible shaft equipment for grinding, wire brushing, polishing and sanding. High speed rotary files also will be exhibited. F. A. Latham, F. A. McKee, R. G. Haskins and H. Goldberg will represent the company.

HAYWARD CO., New York—A working model bridge, an electric motor clam shell bucket and an automatic cable take-up reel will be displayed. Representatives will be H. S. Atkinson, C. S. Sargent and E. J. Robeck.

HERMAN PNEUMATIC MACHINE CO., Pittsburgh—This exhibit will show a ¼-ton high jarr rollover, pattern draw molding machine and ¼-ton jarr stripping plate molding machine in operation. Representatives will include Thomas Kaveny, A. G. Doyle, R. Harris, R. F. Ringle, I. J. Oesterling, Thomas Kaveny Jr., R. P. Morgan, C. S. McMath, C. W. Miller, L. L. Johnston, Joseph W. Gibson, W. W. Hughes, Clarence Shorts, Alfred Herman, Louis Plassmyer and T. A. Repper.

HILL & GRIFFITH CO., Cincinnati — The booth of this company will be fitted up as a rest room. The company will be represented by John Hill, William Oberhelman, Mat Geier, J. A. Reeves, W. J. Adams, C. L. Gysin and Bruce Hill.

HINES MFG. CO., Cleveland—This company will display foundry flasks. James F. Hines, R. J. Hines, W. B. Hines and T. J. Malone will be in charge.

HISEY-WOLF MACHINE CO., Cincinnati—Motor driven grinding machines, snagging grinders, high speed grinders, floor stand grinders and portable grinders will be shown. Representatives will be John W. Friedlander, Roy D. Haworth, W. A. Marschke, George Moerlein, P. A. Rebok, Emil Ritz and H. W. Wallace.

HOLCROFT & CO., Detroit—Photographs, drawings, core and mold ovens, heat treating and annealing furnaces will be displayed. Representatives will be L. M. Lindsey and C. H. Martin.

HOUGHLAND & HARDY, Evansville, Ind.—Molding sands and molding sand control equipment will feature this exhibit. Representatives are C. M. Hardy, Mrs. C. M. Hardy, K. O. Johnson and L. B. Osborn.

I

ILLINOIS CLAY PRODUCTS CO., Joliet, Ill.—Fire clay for bonding molding sand, plastic fire clay for furnace linings, ladle linings, patching and daubing mixtures and a line of foundry refractories, including fire brick, fire clays, refractory cements, plastics and super-refractories will be shown. The company will be represented by O. L. Jones, A. S. Nichols, L. E. Everett, S. K. Minton, L. B. Knight and H. Blackwell.

ILLINOIS TESTING LABORATORIES INC., Chicago—This company will show pyrometers suitable for malleable iron annealing ovens, heat treating furnaces and core oven work. Two new models which have been designed especially for obtaining the temperatures of brass, bronze and copper while still in the furnace also will be displayed. Representatives will be J. A. Obermaier and M. D. Pugh.

INDUSTRIAL MINERALS CO., Columbus, O.—A line of foundry sands for molding, core and cleaning requirements will be shown by this company. The display will be in charge of H. N. Rose and W. G. Edwards.

INDUSTRIAL SILICA CORP., Youngstown, O.—This company will show silica sand for steel molding, furnace bottoms, sandblasting, filtration, steel cores, iron cores, construction, slag pockets, and gannister. E. E. Kloos, J. S. Coxey Jr., Harry H. Smith, C. F. Eberhart, J. E. Ruch and F. R. Thrall will have charge of the exhibit.

INTERNATIONAL MOLDING MACHINE CO., Chicago—The exhibit of this company will consist of a variety of molding machines, including hand and power turn over and jolt turn over machines, hand and power stripping and jolt stripping machines, squeezers, jolt squeezers, and jolt squeeze stripping machines. Several types of core making machines also will be shown. The company will be represented by Edward A. Pridmore, Harold E. Pridmore, Lawrence D. Pridmore, W. W. Miller, W. J. Rowley, M. J. Monahan, E. G. Borgnis, Hugh Gallagher, Luke S. Shannon, J. C. Kingsland, Charles H. Ellis and W. J. Briggs.

INTERNATIONAL NICKEL CO. INC., New York—Members of the development and research staff of this company will be in attendance to discuss the production of nickel alloy castings. Individuals in attendance will be T. H. Wickenden, F. B. Coyle, J. S. Vanick, H. J. French, T. J. Wood, R. L. Suhl, R. A. Wheeler, R. Cooper, Jr., W. C. Kerrigan and E. J. Bothwell.

IRONTON FIRE BRICK CO., Ironton, O.—The exhibit of this company will feature foundry refractories. The company will be represented by E. F. Myers, C. E. Bales, H. W. Walters and C. E. VonLuhrte.

IRON TRADE REVIEW, Cleveland—This booth will be equipped as a rest room for the entertainment of visitors and the display of business publications and technical books. E. L. Shaner, E. C. Barringer, J. D. Knox, E. F. Ross, A. H. Allen, George O. Hays, John Henry and Francis Light will be in attendance.

J

JOHNSON & JENNINGS CO., Cleveland—This company will have a working display of various molding machines featuring a new type of jolt roll-over pattern draw machine. Jolt squeeze machines, jolt squeeze stripping plate machines, plain jolt machines and vibrators also will be shown. J. L. Battenfeld, R. W. Gramling, T. J. Calhoun and J. C. Brainard will represent the company.

W. A. JONES FOUNDRY & MACHINE CO., Chicago—A line of spur, worm and herringbone speed reducers will be shown. Representatives will be W. G. Jones, W. F. Coleman, W. C. Cureton and W. H. Ostring.

K

CHARLES C. KAWIN CO., Chicago—This company will be represented by Charles C. Kawin, W. S. Miller, C. V. Edwards, W. H. Griner, and W. L. Heppner.

KEENER SAND & CLAY CO., Columbus, O.—This company will show its line of molding sand, core and sanblast sands, fire clay and a special bond used for rebonding molding sand. The display will be in charge of C. P. Helmick and E. M. Durstine.

SPENCER KELLOGG & SON SALES CORP., Buffalo—This company will display linseed base core oils, cores made with these oils and a number of finished castings. The following will be in attendance: A. P. Mason, W. L. Goetz, J. N. Yaeger, E. G. Allen, E. A. Medbery, E. E. Sutehall and L. W. Gerrard.

KELLY GRAPHITE MILLS INC., Stockertown, Pa.—Three types of facings will be featured at the display of this company. The representatives will be V. C. Smith,

B. F. Wallace, F. W. Hamel, H. W. Stead, H. C. Seidel, and T. N. Ryan.

KINDT-COLLINS CO., Cleveland—Pattern shop supplies, including a new type of aluminum melting furnace and a pattern shop wood-working machine, will be shown by this company. The exhibit will be in charge of F. J. Sherwin, Oscar Heisterkamp and E. T. Kindt.

KLING BROS. ENGINEERING WORKS, Chicago—Heavy duty, high speed grinders will be displayed by this company. O. E. Kling, H. J. Aagaard and P. E. Kling will be at the booth.

KNEFLER-BATES CO., Indianapolis—Core binders will be on display at the booth of this company. The representatives will be George B. Hill, Herbert J. Bever, John A. Green, H. H. Hollowell, and Mabel Tyner Buck.

H. W. KNIGHT & SON, Seneca Falls, N. Y.—White metal and brass pattern letters, figures and trade marks will be exhibited by this company with H. D. Knight in charge of the display.

H. KRAMER & CO., Chicago—Brass and bronze ingots, including manganese bronze and nickel silver, will be shown by this company. The representatives will be I. Kaden, L. Chapman, S. Marks, William Romanoff, C. O. Thieme, F. F. Heymann, B. P. Cooke, and William C. Yenger.

CHAS. A. KRAUSE MILLING CO., Milwaukee—Core binders and cores made with the core binder manufactured by this company will be exhibited. S. H. Werner, Guy E. Lund, H. D. Farris and B. Y. Leslie will represent the company.

L

LAVA CRUCIBLE CO. OF PITTSBURGH, Pittsburgh—This company will show graphite crucibles for brass and aluminum foundries, crucible rest blocks, crucible furnace covers, lining for crucible, open flame and electric furnaces, super-refractory furnace cements and super-refractory brick, tile and special shapes. Representatives at the convention will be as follows: Furman South Jr., Harold E. White, D. E. MacLean, R. P. South, C. H. Knappenberger and W. T. Gardner.

LINDE AIR PRODUCTS CO., New York—Oxygen, acetylene, and oxyacetylene welding and cutting equipment will be displayed. W. I. Gaston, H. H. Dyar, A. A. Markee, A. T. Post, E. J. Stark, J. Hemmerlein and P. C. Cloane will be in attendance.

LINDSAY-McMILLAN CO., Milwaukee—A display showing the use of core oils, new core testing tensile strength machine, a steel wash and a new core and mold wash for steel foundries will feature the exhibit. William A. McMillan, W. R. Pate, J. A. Gitzen, Zeno LeTellier, R. G. Walker and M. A. Pollard will be at the booth.

LINK-BELT CO., Chicago—This exhibit will feature a full size moving mold conveyor in operation. A vibrator shake-out screen will be shown as well as other equipment for the preparation and handling of sand, molds and castings.

LOUDEN MACHINERY CO., Fairfield, Iowa—A line of monorail equipment for handling materials in the different departments of a foundry, a motor driven unit with step on cab and other accessories will feature the exhibit of this company. Representatives will be R. B. Louden, L. F. Berthold, Bruce Louden, Charles Martin, H. Marette, A. D. Saborsky, E. H. Seelbach, P. L. McCain, W. L. Walker, J. A. Niles and A. H. Neher.

LOWE MFG. CO., Detroit—An electric type sand sifting machine will be on display at the booth of this company. The exhibit will be in charge of R. G. Lowe.

Mc

J. S. McCORMICK CO., Pittsburgh—Foundry facings, core binders and core washs, foundry plumbagos, chill coils, chaplets, and pyramid riddles will be exhibited by this company. J. S. McCormick, H. T. Herr Jr., Frank J. Buerger, H. D. Gowler, C. C. Bumbaugh, H. J. Winters, J. W. Early and J. S. Hamm will represent the company.

R. W. McILVAINE CO., Chicago—Equipment for testing various properties of foundry sand will be exhibited by this company. Representatives will be R. W. McIlvaine, R. L. McIlvaine, A. A. Ross, and W. A. Forbes.

M

MACHINE DESIGN, Cleveland—This booth will be equipped as a rest room for the entertainment of visitors and the display of business publications and technical books. F. H. Johnson, L. E. Jermy, H. B. Veith and W. C. Kremser will represent the company.

MACLEOD CO., Cincinnati—Gravity barrel and hose type sandblast machines, dust arresters, oil burner and cupola lighter, two sizes of swabs and an oil paint sprayer will be featured in this exhibit. James Lauder will be in charge.

PAUL MAEHLER CO., Chicago.—This company will display unit convection heaters for gas and oil fired core and mold ovens. Drawings, photographs and conveyor and kiln type core baking ovens also will be shown. A. E. Maehler, H. R. Madson, H. R. Fox, H. M. White and R. C. Schwarz will represent the company.

MALL TOOL CO., Chicago—Various types of grinding and polishing machines will be featured.

MALLEABLE IRON FITTINGS CO., Branford, Conn.—A vibrator table and a line of springless, regular, double attaching head, flask rapper, pot rapper and core rapper type vibrators will be shown. G. B. Pickop, Raymond Wright and Roger Gustafson will be in charge.

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J.—High speed, rubber bonded, grinding wheels mounted on both stand and swing frame grinders will be shown snagging steel castings. Representatives of the company will be W. H. Steinberg and C. A. Fox.

MARSCHKE MFG. CO., Towson, Md.—This company will have in operation three swing grinders, a constant speed stand grinder for high speed cutting and a stand grinder for snagging aluminum brass and bronze. The company also will show wide type grinders for snagging gray iron castings. Two of the swing grinders will be provided with guards which are adjustable to wheel wear. The representatives will be H. B. Mescaslin, G. J. Coffey, W. J. Fenwick, L. M. Boyd, and J. A. Fairfield.

MATHEWS CONVEYOR CO., Ellwood City, Pa.—This company will conduct an operating exhibit showing the handling of molds from the molding machine to the shakeout and return of the empty flasks. Several types of heavy duty roller conveyors for handling molds, cores and castings also will be shown. Representatives of the company will be F. E. Moore, J. H. Hough, C. A. Adams, M. J. Anderson, A. B. Evans, C. P. Kumler, Jason Smith, F. L. Grady, and Sidney Wasley.

MICHIGAN SCREW CO., Lansing, Mich.—This company will display a line of foundry flask pins and bushings. The exhibit will be in charge of George O. Lundberg.

MICHIGAN SMELTING & REFINING CO., Detroit—The display of this company will feature ingot brasses and bronzes, phosphor bronze ingot, manganese bronze ingot, No. 1 yellow brass, red brass ingot, gun bronze ingot, No. 12 virgin aluminum, 98-99% virgin aluminum, No. 12 remelt aluminum, aluminum alloy ingot, bar and wire solder and babbitt metals. The company also will display castings made from the company's products. R. R. Arnold, Henry Levitt, Charles B. Bloomgarden, R. T. Bloomquist, T. W. Kuhn, A. M. Watson and Harry L. Phillips will represent the firm.

H. E. MILLS MFG. CO., Syracuse, N. Y.—Dry core compounds and foundry facings will feature the exhibit of this company. J. R. Webster will be in charge of the booth.

MILWAUKEE ELECTRIC CRANE & HOIST CORP., Milwaukee—Monorail hoists, crane trolleys and a single line bucket will be exhibited. D. B. Patterson, C. L. Mayer, George Hoffman, Elmer Kapke, George Drake, T. P. O'Neil and H. S. Strouse will represent the company.

MILWAUKEE FOUNDRY EQUIPMENT CO., Milwaukee—Molding machines of various types such as jolt squeezers, jolt squeeze strippers, power jolt hand rollover foot-draw and power jolt rollover draw machines will be shown. Representatives will be H. E. Fellows, N. M. Stuart, C. G. Jurack, L. E. Gregory, T. J. Magnuson and H. W. Bowers.

MODERN POURING DEVICE CO., Port Washington, Wis.—A new combination sand handling and pouring system; a new electric pouring device; a geared ladle up to two tons capacity; and a hot metal transportation system with transfer cranes and monorail system, and other mechanically operated pouring devices will be shown. The company will be represented by M. W. Goldberg, W. W. Drissen, E. J. Welter and W. J. Knappe.

MOLINE IRON WORKS, Moline, Ill.—Squeezer molding machines of the stationary, straddle and side types will be exhibited. B. V. Nutt will be in charge.

MOLTRUP STEEL PRODUCTS CO., Beaver Falls, Pa.—Pattern plates, core plates, bottom plates, cold drawn steel, keys and racks will constitute the exhibit of this company. Those in charge of the booth will include J. T. Moltrup, J. F. Moltrup, J. M. Lithgow, D. C. Russell and F. F. Ward.

MONARCH ENGINEERING & MFG. CO., Baltimore—The exhibit of this company will consist of metallurgical furnaces, core ovens and other equipment. Representatives of the company will be H. D. Harvey, James V. Martin, William H. Raber, William Chenowith, and Harold L. Harvey.

MT. JEWETT FIRE CLAY CO., Mt. Jewett, Pa.—Fire clay for general foundry purposes, clays for bonding molding sands and a high temperature cement will feature the exhibit. The firm will be represented by E. M. O'Neill, A. F. Shaffer, and R. J. Weiser.

N

NATIONAL ENGINEERING CO., Chicago—This company will have in operation an especially designed unit to demonstrate the methods of preparing, handling and reclaiming foundry sands. They also will exhibit an 8-inch diameter pan, intensive type sand mixer, equipped with two discharge doors which are operated by air. Photographs and blueprints of sand handling systems designed by the company also will be shown. H. S. Simpson, A. G. J. Rapp, B. Castor, W. H. Schulte, A. C. Christensen, W. C. Packard, C. J. Skeffington, W. A. Kellogg, W. C. Edgar, G. G. Crewson, A. E. Smith and C. D. Hollins will represent the company.

NATIONAL SMELTING CO., Cleveland—Samples of the various alloys of aluminum which this company produces will be exhibited at the booth. W. M. Weil, A. Rubin, E. S. Christiansen, R. L. Brown and P. Schomer will be in charge of the exhibit.

NEWAYGO ENGINEERING CO., Newaygo, Mich.—A machine for crushing cores, cupola slag, and similar materials will be in operation. Photographs, drawings, etc. showing foundry sand preparation and handling equipment will be shown. Representatives will be W. J. Bell, E. N. Hanlon, C. R. Walcott, B. J. Frenzer and W. H. Slaughter.

NEW HAVEN SAND BLAST CO., Cleveland—A combination sandblast room and dust arrester, a direct pressure sandblast barrel, a radial type sandblast barrel and a roller bearing tumbling mill will be displayed by this company. The representatives will include D. S. Sammis, S. S. Parsons, R. J. Wisely, L. B. Brewster, H. C. Nicholas, F. C. Morey, F. Risen, S. P. George, and W. Mattison.

NEW JERSEY SILICA SAND CO., Millville, N. J.—This company will show samples of various grades of foundry sand for cores, dry sand and green sand molding. The company will be represented by Clarence R. Wolf, Jack Hallard and Clarence Thompson.

NIAGARA FALLS SMELTING & REFINING CORP., Buffalo—A display of special alloys for the manufacture of nonferrous castings and standard brass foundry alloys will be featured. The company will be represented by E. G. Jarvis, J. M. Jarvis, S. Frankel, W. A. Sharp, G. B. Michie, Pearl Mendenhall.

WM. H. NICHOLLS CO. INC., Richmond Hill, Long Island, N. Y.—This company will exhibit various types of molding machines including both stationary and portable types for light and heavy molding. The company will be represented by William H. Nicholls, Hiram L. Ritts, Louis R. Schocken, Dominic Petrocelli, Arthur D. Ziebarth and Gust Anderson.

NORTH AMERICAN REFRACTORIES CO., Cleveland.—A line of plastic, hot set and cold set cements, patching material and monolythic refractories, a model of a malleable furnace bottom and refractories for use in all branches of the foundry industry will feature this exhibit. R. D. Gilmore, E. L. Bohn, H. N. Dean and J. E. McKinley will be in charge of the booth.

NORTHERN ENGINEERING WORKS, Detroit—This company will exhibit in operation a 5-ton, two-motor electric crane trolley, made from aluminum castings and a 1-ton monorail electric hoist also made of the same materials and hoisting loads under power. Representatives are Henry W. Standart, Louis H. Olfs, Charles W. Davis, W. W. Peattie, S. E. Schneider and D. A. Schaitberger.

NORTON CO., Worcester, Mass.—High speed grinding equipment and grinding wheels will be exhibited. A. R. Sandine, R. H. Cannon, F. P. Hayes Jr., G. A. Park and F. H. Stenberg will represent the company.

O

S. OBERMAYER CO., Chicago—This company will show a mixture for pattern making, as well as snap flasks, bands, and jackets, high temperature cements and refractories for furnaces. Representatives will include Theodore Kauffmann, S. T. Johnson, F. B. Flynn, T. Kauffman Jr., G. Deyette, E. D. Frohman, W. R. Cummings, W. C. Samuels, L. A. Gosiger and O. J. Peterson.

OILESS CORE BINDER CO., Cleveland—Core binders, mold wash and core paste will be exhibited by this company. In addition castings produced with these materials also

will be shown. Representatives will include J. H. Bruce, J. A. Hamilton, H. A. Baker, and H. B. Fischer.

OLIVER MACHINERY CO., Grand Rapids, Mich.—Direct motor-on-arbor woodworking machinery and other pattern shop equipment will be shown. The company will be represented by A. S. Kurkjian, H. B. Tuthill, J. R. Duthie, B. W. Middletown, C. R. Crossley, C. A. Ginter, J. E. McLauchlen, G. C. Conklin, G. W. Crosley, F. Conibear and Henry E. Brasseur.

OSBORN MFG. CO., Cleveland—A number of molding machines for the manufacture of both cope and drag molds will be in operation in the booth of this company. The following representatives will be in attendance: F. G. Smith, M. W. Zeman, R. W. Hisey, E. F. Oyster, J. D. Wise, E. T. Doddridge, F. T. Spikerman, R. E. Kiefer, H. B. Klar, G. G. Adam, R. C. Miller, R. F. Lincoln, W. Dougherty, H. T. Preston, L. F. Miller and M. K. Rear.

P

PALMER-BEE CO., Detroit—A model of a pendant type mold conveyor driven by a herringbone speed reducer, made by the company, will feature this company's exhibit. Reducers and trolleys which the company manufactures also will be shown. The booth will be in charge of J. E. McBride, D. B. Sestock, and Frank Fones.

PANGBORN CORP., Hagerstown, Md.—This company will exhibit a new type automatic, rotary table sandblast with direct pressure, automatic, continuous operating pressure tank; a direct pressure, quick loading, sandblast barrel with automatic, unloading equipment; a core knockout machine, an abrasive separator; a new moisture and oil separator with continuous automatic drain; a cloth screen dust collector with screen frames; and photographs of various types of sandblast and dust collector installations. Thomas W. Pangborn, John C. Pangborn, P. J. Potter, F. J. Hull, W. A. Rosenberger, H. D. Gates, C. A. Boultman, M. I. Dorfan, A. M. Oliver, Harold Holden, W. C. Lytle, J. J. Carr, C. T. Bird, R. M. Trent, L. W. Wagner, W. T. Randall, F. E. Wolf, B. R. Artz and E. C. Gilmour will be in attendance.

PATCH-WEGNER CO. INC., Rutland, Vt.—Samples of chilled steel shot and grit for steelblasting will be shown.

PEERLESS SAND CO., Conneaut, O.—This company will exhibit a line of molding sands, core sands and fire clays for all branches of foundry practice. The company will be represented by F. L. Moore, and C. E. Moore.

PENNSYLVANIA LUBRICATING CO., Pittsburgh—A display of core oils and cores and castings made with these core oils will feature the exhibit of this company. John M. Lutz, G. R. Meyers, L. M. Hickson, H. J. Strassberger, H. P. Bittinger, G. H. Brinkmeyer, C. N. Wolgamood, G. F. Morgan, F. R. Johlie, R. B. Bedford Jr., and R. G. Blakeley will represent this company.

PENTON PUBLISHING CO., Cleveland—This booth will be equipped as a rest room for the entertainment of visitors and the display of business publications and technical books. The company will be represented by C. J. Stark and J. D. Pease.

GEORGE F. PETTINOS, Philadelphia—Representative samples of foundry sands and facings, and general foundry supplies will be shown. George F. Pettinos, G. A. Doughten, J. R. Cooney, D. S. Yeomans, J. H. Hatten, T. H. Walker, E. G. Stratton and F. H. Goodfellow will be in attendance.

PICKANDS, BROWN & CO., Chicago—Samples of pig iron will feature the display of this company.

PITTSBURGH ELECTRIC FURNACE CORP., Pittsburgh—This company will display and operate a ½-ton per hour electric furnace, supplying gray iron on a continuous cold melting plan. Representatives of the company will be W. B. Wallis, W. E. Lewis, H. H. Watson, G. L. Simpson, Presley Hamilton, W. H. Payne, F. E. Gibson, Webb L. Kammerer, Alexander Haigh and W. E. Moore.

PRECISION GRINDING WHEEL CO. INC., Philadelphia—Vitrified silicate, bakelite, rubber and shellac bonded grinding wheels will be displayed. Representatives will be A. S. Vane, L. C. Griffin, B. J. Lyons and Chas. Drake.

R

N. RANSOHOFF INC., Cincinnati—The feature of this company's exhibit will be a star return tumbling barrel. Other items of foundry equipment also will be shown. The following men will be in charge of the exhibit: N. Ransohoff, D. M. Powers, J. H. Hopp, H. E. Epley and J. S. Miller.

READING CHAIN & BLOCK CORP., Reading, Pa.—This company will show chain and electric hoists, a traveling crane, monorail system and trolleys. George R. Harrison and F. H. Howard will be in charge.

REEDER MFG. CO., St. Louis—The exhibit of this company will feature nonchillable chaplets and brass chill ribs or cracking strips. C. H. Reeder and C. L. Harrell will be in charge.

ROBBINS & MYERS SALES INC., Springfield, O.—The hoist and crane division of this company will be in charge of the exhibit, which will show electric hoists of various

types including both light and heavy equipment. F. F. Seaman, J. R. Mears, C. E. Schirmer, Albert Kreh, William J. Scott, J. J. Becker and E. S. Ludlow will be in charge of the exhibit.

ROBESON PROCESS CO., New York—Numerous cores of various shapes and sizes made with binders that the company manufactures will features the display. Representatives will be Gordon I. Lindsay, B. W. Bullen, T. J. Ryan, T. J. O'Hara, and J. A. Smith.

ROGERS BROWN & CROCKER BROS. INC., Cincinnati—The exhibit of this company will feature an elaborate display of pig iron, coke, ferro-alloys, fluor spar, molding sand, fire clay, etc., in celebration of the fiftieth anniversary of the company.

ROTOR AIR TOOL CO., Cleveland—This company will exhibit its line of portable pneumatic grinders, buffers, sanders and drills. A new type buffer for light sanding operations will be exhibited for the first time at the display where the various type tools will be in operation. Those who will represent the company will be H. P. Bailey, K. L. Pohlman, W. G. Baily, J. G. Cooper, A. L. Brum Jr., R. H. King, F. B. Engeln, and C. B. Scott.

ROYER FOUNDRY & MACHINE CO., Wilkes-Barre, Pa.—Models of the sand separator and blender manufactured by that company and a new type of equipment designed to remove scrap from foundry sands will feature the exhibition. G. F. Royer, John Lloyd, S. B. Davies, Alexander Haigh, William Fenton and Stewart Lloyd will represent the company.

JOHN ROYLE & SONS, Paterson, N. J.—Precision saw-tables for patternmakers will be featured by this company. The exhibit will be in charge of William Holt.

RUEMELIN MFG. CO., Milwaukee—A sanitary sandblast cabinet, sandblast generator, vacuum type dust arrester, direct connected motor driven exhauster fan, sandblast guns, operators' helmets, moisture and oil separators and sandblast nozzles will be displayed. R. Ruemelin and M. F. Reinhold will represent the company.

S

SAFETY CLOTHING CO., Cleveland—Leather, asbestos and duck leggings and clothing, gloves, mittens, hand pads, helmets, blankets and sleeves will be exhibited. Allen Clark, B. K. Clark, R. S. Douglas C. R. Wefler and E. W. Pierson will represent the company.

SAFETY EQUIPMENT SERVICE CO., Cleveland—This company will display goggles, respirators, masks, safety clothing, gloves, leggings, aprons, safety devices and equipment. Representatives are Buell W. Nutt, Harry Lea and F. C. Blake.

SAFETY FIRST SHOE CO., Framingham, Mass.—This company will show shoes for foundrymen.

SAFETY GRINDING WHEEL & MACHINE CO., Springfield, O.—The display of this company will feature motor driven floor stand grinders, portable swing frame grinders and grinding wheels for medium and high speed. Representatives will be H. G. Bennett, W. H. Vance, D. R. Stewart, H. W. Lanyan, H. G. Weinland and Chas. W. Gwyn.

SAND PRODUCTS CORP., Detroit—This company will show samples of core sand.

SEMET-SOLVAY CO., New York—This company will show foundry coke, protective paints for resisting corrosion of steel and iron and sample castings. James M. Woods, E. L. Kyle, A. E. Scherm, Samuel Weiss, Alfred Fischer, John Daker, R. H. Watson, W. S. Shelow, Charles P. Ryan, A. P. McClure, E. J. Rowe, Gerald Nash and Leigh Willard will represent the company.

SHEPARD NILES CRANE & HOIST CORP., Montour Falls, N. Y.—This company will show single I-beam hot metal carriers, mechanical cupola charging equipment, and several types of compact hoists. The company will be represented by F. A. Hatch, S. Bucklet, R. T. Turner, F. E. Meeks, W. B. Briggs, G. G. Robbins, H. A. Baugh, J. D. Gillette, L. Kunzmann and E. H. Merrick

W. W. SLY MFG. CO., Cleveland—Tumbling mills, dust arresters, sandblast equipment and other foundry supplies will be featured by the company. Some of the models will be in operation. Those who will be in attendance will include S. C. Vessy, F. A. Ebeling, G. A. Boesger, D. L. Harris, H. W. Gaeckle, C. P. Guion, E. M. LaMotte, M. T. Mortensen, C. F. Dunasky, R. G. Abbey, W. L. Kammerer, R. W. Hasselle, J. L. McVoy and B. C. Rochester.

EUGENE W. SMITH INC., Evansville, Ind.—This company will show samples of molding sands. Representatives will be Eugene W. Smith Sr., Eugene W. Smith Jr., and J. H. Warner.

WERNER G. SMITH CO., Cleveland—Core oils and specimens of cores made with the core oil that this company manufactures will be exhibited. Representatives will be Werner G. Smith, L. P. Robinson, I. M. Gerteis, O. E. Steep, George H. Graham, M. M. Werckman, M. S. Finley, Ray Hunter, Frank H. Dodge, A. S. Coulter, John M. Glass, William E. Rayel, S. E. Shaver, Dr. Wallace Alexander, N. A. Boyle, and Louis F. Ferster.

SMITH FACING & SUPPLY CO., Cleveland—A line of foundry facings will be displayed by this company. Those in attendance at the booth will be G. W. Fleig, F. Ray Fleig and J. S. Smith.

SMITH-MONROE CO., South Bend, Ind.—This company will show compressed air separators and compressed air after coolers. R. O. Monroe will be in charge.

SMITH OIL & REFINING CO., Rockford, Ill.—Various types of cores made with core oil manufactured by the company will be displayed. O. S. Smith, J. B. Perkins, F. C. Maley, J. J. Maley and S. K. Smith will be at the booth.

SPENCER TURBINE CO., Hartford, Conn.—A 15 horsepower centrifugal type turbo compressor for supplying air to foundry cupolas, and a 5 horsepower turbo compressor used for oil or gas fired furnaces will be exhibited. The company will be represented by F. A. Wright, O. J. Dingee and R. A. Brackett.

STANDARD CONVEYOR CO., North St. Paul, Minn.—The company will show a grease protected type gravity roller conveyor designed for foundry use. P. C. Wego, E. E. Boberg and W. W. Zick will be in charge of the booth.

STANDARD SAFETY EQUIPMENT CO., Chicago—Featured in this exhibit will be industrial safety equipment, such as goggles, sandblast masks, safety washers for grinding wheels, and protective clothing. Representatives will include L. E. Dickson and S. W. Montgomery.

STANDARD SILICA CO., Chicago—Silica blast sand, furnace bottom sand, core sands, sands for rebonding, steel molding sand, and silica flour or silica wash will be shown. A. C. Goodnow, R. W. McCandlish and L. D. Chadwick will represent the company.

STEELBLAST ABRASIVES CO., Cleveland—This company will display various grades of steel grit and shot and samples of work cleaned with that material. Representatives will be S. S. Parsons, C. M. Bolich, O. C. Sabin, E. L. Beisal and E. J. Carroll.

STERLING WHEELBARROW CO., Milwaukee—This display will feature foundry flasks, wheelbarrows and other foundry specialties. The company will be represented by H. H. Baker, R. F. Jordan, George H. Lambkin, Harry J. Felsburg, J. J. Coyne, J. M. Dickson, J. A. Patterson, Otto E. Steep, and J. A. Morrissey.

FREDERIC B. STEVENS, INC., Detroit—Foundry equipment, facings and supplies will feature this exhibit. Frederic B. Stevens, W. J. Cluff, J. M. Mayers, J. F. Hughes Jr., J. M. Johnston, T. H. Ledden, W. H. Dee, Dan Campbell, W. W. Bowring, G. H. Quinn, H. Laycock, C. J. Menzemer, J. L. Conboy, W. H. Dean, H. S. Taylor and J. G. Fox will be at the booth.

STONE PATTERN MOUNT CO., INC., Bloomfield, N. J.—This company will feature methods of mounting, using its special compound. Charles Quast will be in charge of the exhibit.

STONEY FOUNDRY ENGINEERING & EQUIPMENT CO., Cleveland—Various types of shakeout and core knockout machines, a core grinder and a new type vibrator will feature the display of this company. E. S. Cohen, J. T. Stoney, R. E. Stoney, G. A. Scott and L. J. Reinhard will represent the company.

SUGAR PINE PATTERN LUMBER EXHIBIT—This display will include specimen boards of each grade of sugar pine pattern lumber. The following producers will exhibit: California Door Co., Diamond Springs, Calif.; Madera Sugar Pine Co., Madera, Calif.; McCloud River Lumber Co., McCloud, Calif.; Michigan-California Lumber Co., Camino, Calif.; Pickering Lumber Co., Standard, Calif.; Red River Lumber Co., Westwood, Calif.; and Sugar Pine Lumber Co., Pinedale, Calif. Emanuel Fritz will be in charge.

SUPERIOR SAND CO., Cleveland—This company will exhibit samples of 19 molding sands. The company will be represented by H. C. Kontz, W. T. Findley and T. F. Goebig.

T

TABOR MFG. CO., Philadelphia—This company will exhibit a line of molding machines and equipment. The company will be represented by F. R. Wallace, J. T. Ramsden, J. Horace Coleman, H. W. Impey, William E. Sewell, T. L. Sumner, Leicester S. Lewis, P. J. Shire, V. H. Curren, J. Lee Allen, and Robert M. Maull.

WARNER R. THOMPSON CO., Detroit—The display of this company will feature core and molding sands. Representatives will be Warner R. Thompson, W. Edward Thompson, Fred A. Cowen, and Charles L. Cruikshank.

TIONA PETROLEUM CO., Philadelphia—This company will show two kinds of core oils and a metal cutting lubricant. Representatives will include William H. Bassett, H. E. Washburn and E. H. Ward.

TOTTENVILLE COPPER CO., INC., Tottenville, N. Y.—Brass and bronze ingots, white metal alloys in pigs, and bars and castings made from these metals will be shown. Leo Lowenstein, Arthur Lowenstein, Eugene Weingartner, Sam Siegel and Walter Taegen will be in attendance.

TRUSCON STEEL CO., Cleveland—This company will show alloy steel flasks, core plates, bottom boards, boxes, platforms and other supplies. H. E. White, H. Woodhead, R. C. Rose, N. C. Ferreri, H. G. Frohnapple, H. A. Beattie, E. R. Warnke, John Skove, A. H. Kroenke and J. F. Conrad will be in charge of the display.

TUSCORA SAND & COAL CO., Cleveland—Molding and core sands will be exhibited. C. D. Pinkerton, O. D. Clay and B. D. Fuller will represent the company.

W. S. TYLER CO., Cleveland—This company will exhibit electric screens, a sand testing sieve shaker, a set of standard screen scale testing sieves and woven wire cloth. F. S. Curtis and N. E. Kile will be in charge.

U

UNITED COMPOUND CO., Buffalo—Vent wax and cores showing the use of that material will be shown. Representatives will be W. F. Bradley and L. F. Leney.

(Concluded on Page 226)

Over Annealed Steel Is Recognized Through X-ray Spectrometry

By H. A. Schwartz

GREAT difficulty can be encountered in distinguishing under the microscope between steel castings which are not annealed at all and those which have been annealed at abnormally high temperatures. Both may present the so-called Widmanstatten structure which is formed by the deposition of ferrite in the cleavage planes of gamma iron. This deposition can take place whenever iron is held sufficiently long in the proper temperature ranges, irrespective of whether this be during cooling from a casting temperature or during a subsequent heat treatment.

Used To Determine Treatment

While it is probable that similar microstructures represent similar physical properties, we can not always rest content with that conclusion but may be confronted with the need of determining what has actually been done to a given piece of steel which may be in dispute. The science of X-ray spectrometry permits of definite conclusions being reached on this matter. The method used is substantially that bearing Laue's name.

If the metal under investigation is polished down, avoiding cold working stresses, to a sheet a few thousandths of an inch thick and a narrow pencil of parallel X-rays is allowed to pass through it and impinge upon a photographic plate at some distance behind the metal specimen, certain characteristic patterns are obtained.

Describes the Pattern

We need not go into the physical and mathematical principles involved, but will concern ourselves only with what we can actually see. If the metal specimen consists, as it does when fully annealed, of many, many crystalline grains, each of small size and all located at random in space and further, if the beam of X-rays be monochromatic, that is of one wave length only, then the pattern on the plate will consist of a central, circular spot, where the pencil of X-rays has passed straight through the specimen and exposed the plate; and a series of circles surrounding this center, the circles being quite narrow and uniform in degree of blackening or intensity. The radius of the rings is determined by the wave length of the X-rays and by the kind of metal

Advances Knowledge

WHILE microscopic examination has done much to advance the metallurgical knowledge of metals and alloys, particularly steel, it does not always reveal all there is to be known structurally about the material under examination. This is due to the fact that under certain widely varying conditions, the structures shown under the microscope are apparently the same. Within recent years considerable has been accomplished in developing the application of X-ray study to metals, and this has done much to amplify the knowledge of metal characteristics. This article by Mr. Schwartz, who will receive the Penton medal awarded by the American Foundrymen's association at the coming convention, is a distinct contribution to scientific investigation in the foundry field.

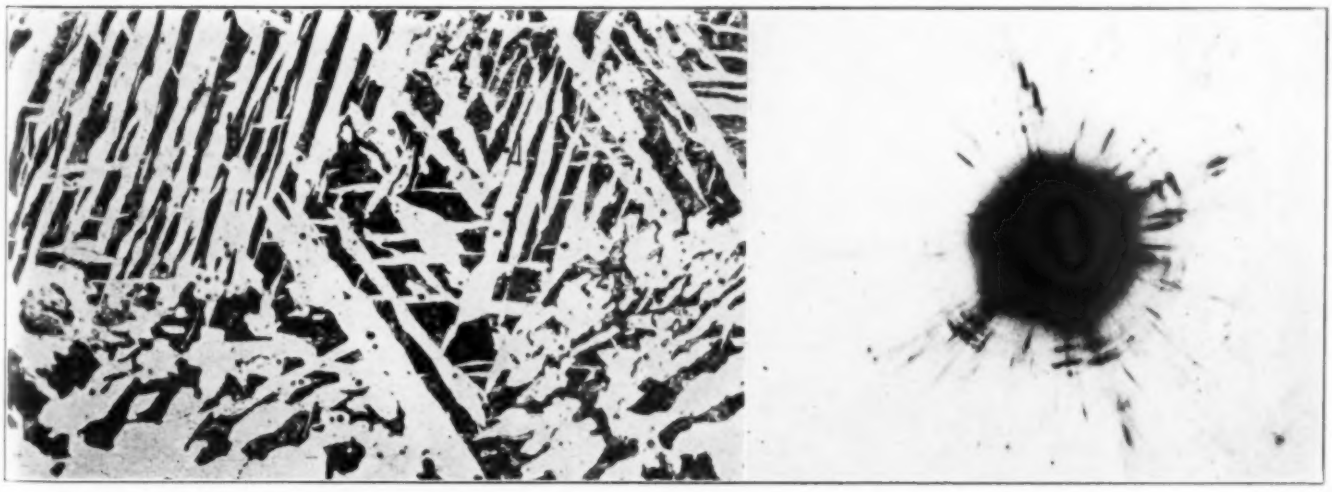


FIG. 1—MICROGRAPH OF A SPECIMEN OF STEEL IN THE AS CAST CONDITION. FIG. 2—X-RAY SPECTROGRAM OF THE SAME METAL

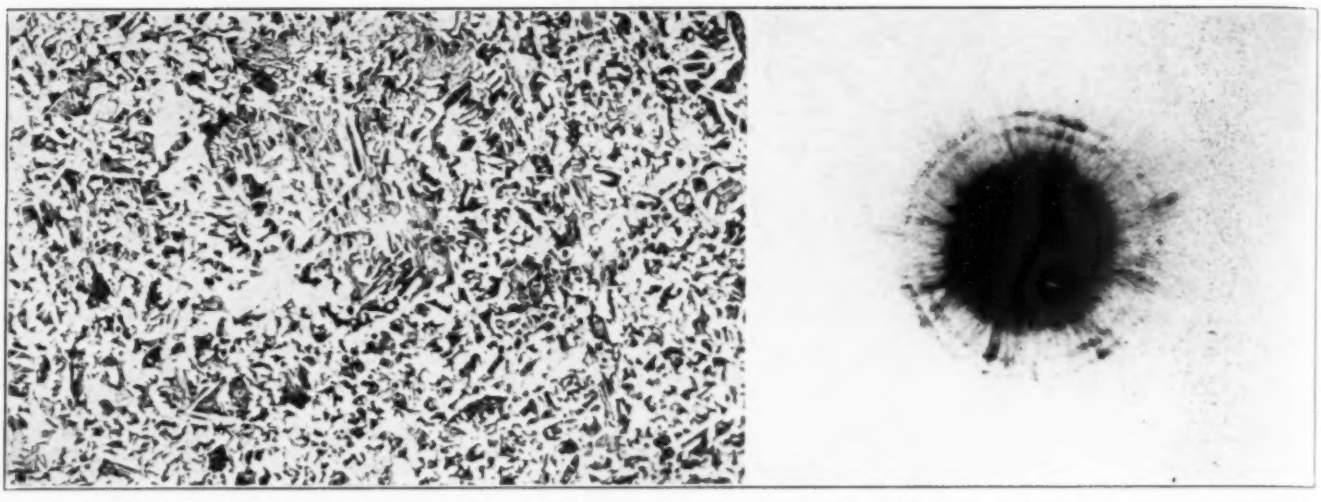


FIG. 3—APPEARANCE OF THE STRUCTURE OF THE SAME METAL NORMALIZED FROM ABOUT 875 DEGREES CENT. FIG. 4—SPECTROGRAM OF THE METAL UNDER THE SAME CONDITION

under investigation and is substantially the same for any kind of steel. If there are waves of several frequencies in the beam, there are as many sets of rings as there are wave lengths. For example, the waves from the molybdenum target of the usual Coolidge tube are preponderantly of two frequencies so that instead of there being a single series of rings there are a series of pairs of rings or double rings, the two rings of a pair being relatively close together.

Explains Meaning of Rings

If now instead of the small crystallites being arranged at random, the specimen consists of larger grains or group of grains having certain definite positions in space, the rings of the spectrogram will not be of uniform intensity throughout, but will be more intense at some spots and less intense or indeed perhaps have gaps at others.

Generally also a tube gives off radiation of short wave lengths which, in the interval between the central spot and the inner circle of the spectrogram produce a pattern somewhat like the rays surrounding the sun, particularly if the steel specimen has internal strains from cold work or cooling stresses. This asterism will not be distributed uniformly around the central spot if there be a preferred orientation of strained grains, but will be intense along some radii and diminished or absent along others.

FIG. 7—THE SPECTROGRAM BY ITS REGULARITY PROVES THE OVER ANNEALED CONDITION TO EXIST

Depends on Grain Condition

During freezing, steel forms rather large crystalline masses called dedrites which means a preferred orientation in the cold specimen so that the investigation of an *as cast* steel by the Laue method discloses an irregular pattern both as to the intensity of the rings and as to the directional symmetry of the asterism. The relief of strain during annealing and the recrystallization on passing to and fro through the critical range produce an increased uniformity of pattern and it is this change from strained and preferentially oriented metal toward unstrained and randomly oriented that we are able to use for our present purpose. Norman Goss kindly has made for the author certain Laue spectograms illustrating further the matter which is under discussion.

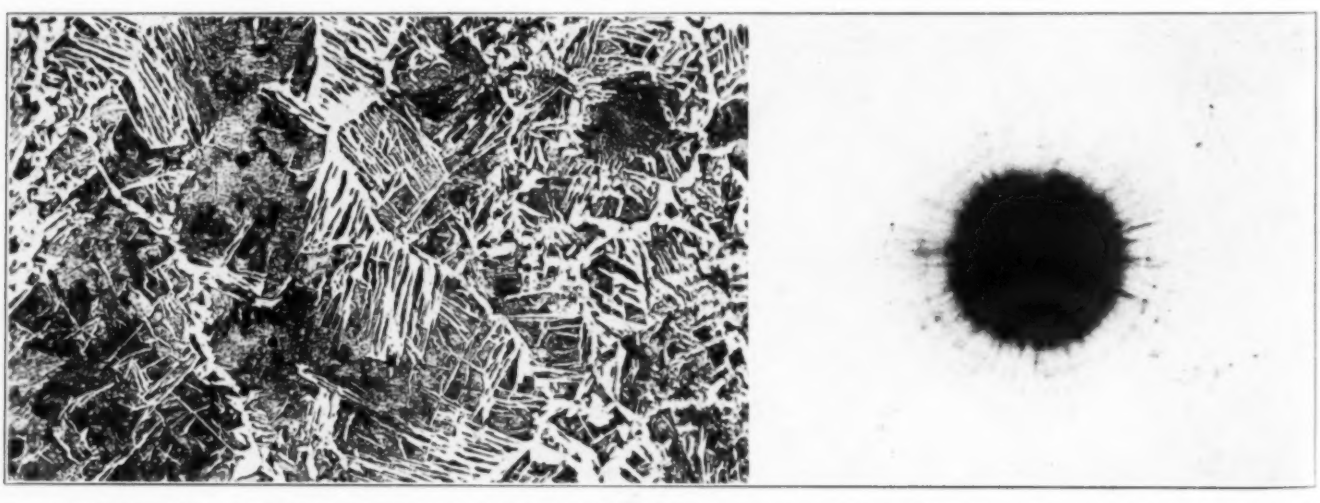


FIG. 5—MICROGRAPH OF THE SAME STEEL AS IN FIG. 1 NORMALIZED FROM THE ABNORMALLY HIGH TEMPERATURE OF 1100 DEGREES CENT. AND TYPICAL OF AN OVER HEATED STEEL. FIG. 6—SPECTROGRAM OF THE SAME STEEL

Fig. 1 is a micrograph of an *as cast* steel specimen and Fig. 2 is the spectrogram of the same metal. Figs. 3 and 4 represent the same metal normalized from about 875 degrees cent. a proper temperature, and Figs. 5 and 6, the same metal normalized from the abnormally high temperature of 1100 degrees cent. Fig. 5 is still distinctly typical of an over heated steel, probably due to the cooling rates adopted, but is beginning to show the coarsening due to high temperature. Fig. 8 shows a Laue spectrogram of the same steel after passing through a malleable annealing cycle which, though producing an undesirable steel microstructure, largely has reduced strain and shows a pattern made up largely of fairly clearly defined target images and an approach to complete elimination of strain in the crystal lattice. Fig. 9 is a micrograph of a commercial steel casting which will not permit decision as to whether it is over or under annealed. Fig. 7. by its regularity, shows clearly that the sample has been heat treated thoroughly and hence proves the over annealed condition to exist, not the under annealed and so serves to remove all doubt.

The author is indebted to Mr. Goss for the preparation of the spectrograms and for helpful discussion of the problem, to C. H. Junge for the micrographs and to T. C. Chapman for the experimental heat treatments.

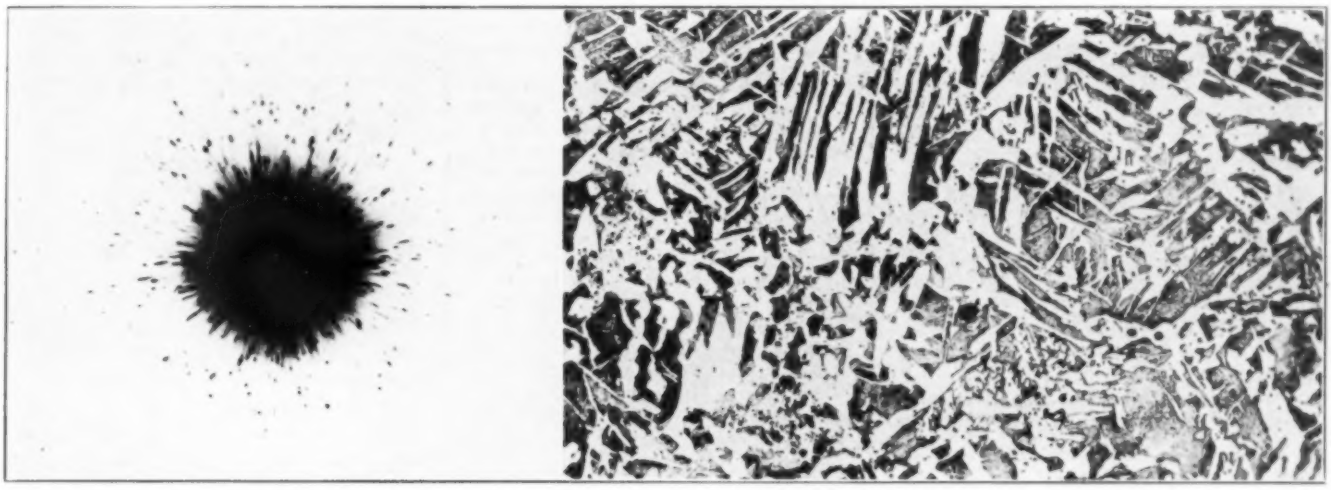


FIG. 8—THE LAUE SPECTROGRAM OF THE ORIGINAL STEEL AFTER PASSING THROUGH A MALLEABLE ANNEALING CYCLE SHOWING THE REDUCTION OF STRAIN BY THE CLEARLY DEFINED TARGET IMAGES. FIG. 9—MICROGRAPH OF A COMMERCIAL STEEL WHICH WILL NOT PERMIT DECISION ON WHETHER IT IS OVER OR UNDER ANNEALED

Newark Foundrymen Meet

The regular monthly meeting of the Newark Foundrymen's association was held at the Down Town club, corner Broad and Market streets, Newark, N. J., on April 23. The meeting was addressed by Arthur J. Tuscany, Gray Iron institute, on, "The Gray Iron Industry Wakes Up."

British Iron and Steel Institute To Meet

The annual general meeting of the British Iron and Steel institute will be held at the Institute of Civil Engineers, Great George street, Westminster, London, on May 1 and 2. The annual report will be presented, and new members will be elected on the first day. Presentation of the two Bessemer gold medals to Eugene Schneider and Dr. Walter Rosenhain will be a feature of the first day's session. On the second day the award of the Andrew Carnegie research scholarships for 1930-31, and the award of the Williams prize to W. E. Simons, Cardiff, Wales, will be announced. The annual dinner will be held in the grand hall of the Connaught rooms, London, on May 1. The whole proceedings will be under the chairmanship of Prof. Henry Louis, who holds the chair for the second year in succession in accordance with the modification in the regulations, by which all presidents are elected for two years.

Among the papers to be presented at the meeting are the following: "Some Alloys for Use at High Temperatures. Nickel-Chromium and Complex Iron-Nickel-Chormium Alloys," Part I, by W. Rosenhain and C. H. M. Jenkins; Part II, by C. H. M. Jenkins, H. J. Tapsell, C. R. Austin and W. P. Rees; "Developments in Fuel Economy at Skinninggrove," by F. Bainbridge; "Carburizing and Graphitizing Reactions Between Iron-Carbon Alloys, Carbon Monoxide and Carbon Dioxide," by M. L. Becker; "The Metallography of Some Ancient Egyptian Implements," by Sir H. C. H. Carpenter and J. M. Robertson; "Alloys of Iron Research. Part IX—The Constitution of the Alloys of Iron with Silicon," by J. L. Haughton and M. L. Becker; "The Effect of Melting Conditions on the Microstructure and Mechanical Strength of Gray Cast Irons Containing Various Amounts of Carbon and Silicon," by A. L. Norbury and E. Morgan; "The Properties of Some Steels Containing Chromium," by A. R. Page and J. H. Partridge.

Following the annual general meeting held in London, additional meetings will be held at the Birmingham chamber of commerce, May 6, and at the Royal Metal exchange, Swansea, May 13. Seven of the papers presented at the general meeting will be discussed at these meetings. The autumn meeting of the institute will be held at Prague, Czecho-Slovakia, Sept. 15 to 20, under the presidency of Prof. Henry Louis.

Has Eight New Members

Gray Iron institute, Terminal, Tower building, Cleveland, has admitted the following companies to membership in the organization: D. G. Foundry Co., Chicago Heights, Ill.; Mid City Foundry Corp., 945 West Forty-ninth street, Chicago; Sibley Machine Co., 206 East Tutt street, South Bend, Ind.; Peru Foundry Co., Peru, Ind.; Buckeye Foundry Co., 2257 Buck street, Cincinnati; Spring City Foundry Co., Waukesha, Wis.; Brillion Iron Works, Brillion, Wis., and Porto Rico Works, Inc., Real 30, Ponce, Porto Rico.

The bureau of standards recently has published a bulletin giving an alphabetical and numerical index of the federal specifications promulgated by the federal specifications board. The bulletin is issued as bureau of standards circular No. 378 and the price is five cents.

Questions & Answers on FOUNDRY PRACTICE

GRAY IRON

Is Not Stainless

QUESTION

Can you give us any data on what has been done along the lines of making cast iron stainless, non-rusting, non-corrosive, etc., by the addition of chromium or other metals?

ANSWER

Cast iron containing from 12.5 to 16.5 per cent chromium does not show any loss in weight when heated for 48 hours at a temperature of 1832 degrees Fahr. according to Poister. However, cast iron containing this range of chromium is hard and brittle unless the carbon content is under 3.0 per cent. At 2.5 per cent carbon the metal has a dense, fibrous structure. Cast iron containing from 1 to 2.5 per cent chromium with 2.5 per cent silicon is used for annealing pots or other similar heat resisting castings. This material is said to resist heat and abrasion, is not brittle and has fair machinability. However, to obtain the protection of chromium to the fullest extent, the percentage has to be over 7 per cent and preferably in the ranges first mentioned. Grinding balls containing 0.40 to 0.50 per cent silicon and 3.50 per cent chromium are claimed to render good service.

As far as we are aware there is no stainless cast iron. Materials in that class are classed as steels as they have low carbons and the chromium content is 16 per cent or over. According to Poister, cast irons containing from 0.40 to 18.5 per cent chromium rusted when tested with a salt spray. According to Koetzschke chromium additions of 1 per cent substantially diminish acid corrosion, and 5.7 per cent nickel reduces alkali corrosion to 1/16 that of a plain 3 per cent silicon iron. Koetzschke also states that the silicon content in acid or corrosion resisting castings should be kept as low as possible. He also states that 0.9 per cent copper additions to cast iron reduce the effect of atmospheric corrosion.

High silicon iron containing 13 to 14 per cent silicon is used in chemical plants for acid resisting castings. It is hard and brittle and due to its high contraction in freezing is difficult to mold.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall—Cast Steel
H. A. Schwartz—Malleable Cast Iron
J. W. Bolton—Gray Cast Iron

All questions should be addressed to The Editor, The Foundry, Penton Building, Cleveland.

Q & A

Wants to Reduce Coke

QUESTION

I am operating a 62-inch cupola with a coke bed 36 inches above the tuyeres, 3000-pound iron charges with 350-pound coke splits. How can I reduce the bed to 33 inches above the tuyeres and get a coke ratio of 10 to 1? Formerly the cupola was lined to 72 inches with a 62-inch well and the bed was 33 inches with a 10 to 1 coke ratio. However, after making a straight 62-inch lining the bed and the coke ratios had to be increased. The cupola averages 9 charges per heat, and I am having difficulty in that the patching in the melting zone seems to slide down and bridge over at the tuyeres. The tuyere has 11 openings with an area of 742 square inches. A positive blower is used and when started the gage shows 24 ounces which drops to 16 ounces in the course of the heat.

ANSWER

Theoretically you should be able to obtain the same results with a straight-lined cupola as you can with a bosh-lined cupola, but many foundrymen prefer the latter type. The bosh effect in many cupolas is obtained by putting on a layer of split brick, silica rock or mica schist in the melting zone which decreases the diameter at that point. One thing that strikes us is your reference to the patching sliding down. This should not occur under any condition and may be due to a poor grade of fireclay used in the patching mud, or that the cupola lining is not chipped properly. The lining must be chipped clean and a clay as refractory as the brick used. If the clay is poor, it fuses and lets the patching slide down to cause trouble by bridging, etc. Another cause may be that the patching is put on too thick. Use less clay by filling the holes up with silica rock, brick, etc.

Your tuyere area at first glance appears much too great, but upon consideration, we believe that your tuyeres are of the flared type with openings 4 x 17 inches at the lining and 4 x 10 inches at the back. If the opening at the back is approximately that given, the tuyere area will be about 15 per cent of the cupola diameter which is recommended for a cupola of the size mentioned.

You also mention that you obtain a pressure of 24 ounces when you start the cupola and that it drops to 16 ounces later. Usually this works the other way as the charges in the cupola are more open at the beginning and become slightly choked with slag, crushed coke, etc., as melting proceeds. Pressure values as a general rule do not convey much information except that the cupola is not

bridging, bunging up, etc. The only way to tell how much air the cupola is getting, is to determine it by some type of meter for determining volume or weight, or since you have a positive type blower, calculate the quantity of air it supplies. The blower probably has a name plate stating the quantity of air delivered per revolution. That value times the number of revolutions per minute will give the quantity of air delivered. Some loss will occur due to slippage, etc., particularly if the blower is old and worn. Allow for that in your calculations.

With 300-pound coke splits you should supply 39,600 cubic feet of air and with 350-pound splits, 46,200 cubic feet of air to melt one charge of iron. This is based on the premise that it takes 132 cubic feet of air at 60 degrees Fahr. to completely burn 1 pound of coke containing 88 per cent carbon. To determine the air supply per minute, determine how many charges of iron are melted per hour. This figure multiplied by the air supply necessary per charge, divided by 60 will give the quantity necessary per minute. Then regulate your blower so that it will supply the proper amount.

The best way to determine the bed height for your cupola is to watch the iron melting through the peepholes in the tuyeres. The drops of molten iron should begin to come down rapidly in about 6 to 8 minutes. If it takes much longer than this, reduce the bed a little at a time until the proper point is reached. With the right bed and the correct amount of coke, your iron will melt hot and quick, and you should adjust your cupola operations so that this will take place.

Q & A

Adds Chromium to Mix

QUESTION

I understand that alloys are added to cast iron used for aluminum melting pots. Have you any information on this subject? What is the best composition and the amount of steel scrap to use? The pots to be made are 1¾ inches thick and weigh 4000 pounds.

ANSWER

According to consumers and manufacturers of cast iron pots for melting aluminum, chromium additions to the metal give added life to the pots. A German metallurgist experienced in nonferrous metallurgy suggests the following composition for gray iron pots for this work: Total carbon, 3.5 per cent; combined carbon, 0.4 per cent; manganese, 0.80 per cent; sulphur maximum, 0.15 per cent; phosphorus maximum, 0.50 per cent, and silicon, 2.25 per cent. To make it more resistant to heat chromium additions of 2 per cent are made. He bases his suggested analysis on experimental work which showed that iron high in combined carbon caused less pickup of iron by the aluminum.

Another composition which is claimed to be giving good results contains about 1 per cent chromium and 0.5 per cent nickel. The silicon ranges from 1 to 2 per cent; phosphorus maximum, 0.10 per cent; manganese, 0.40 to 0.50 per cent, and the total carbon, 3.00 to 3.25 per cent. About 40 per cent steel will assist in holding the carbon low and give a finer structure. To keep the phosphorus around the limit specified, low phosphorus scrap and malleable bessemer pig iron will have to be used.

GENERAL

Vent Prevents Scabbing

QUESTION

We are having some trouble with the cores for pistons ranging in weight from 8 to 80 pounds. These cores seem to cut on the corners down at the head of the piston and also under the pin bosses. We use an oil bonded sand with just enough dry binder to give the cores a body while in the green state. We shall appreciate your opinion on this problem.

ANSWER

We are rather surprised to learn that the core mixture given does not work satisfactorily. However, from the fact that the cutting takes place in the corner of the head and under the pin bosses it is apparent that the sand is just a little too tight. In other words the sand is not quite permeable enough to allow the gas to escape readily from those points where, on account of two iron walls close together, it is generated in greatest quantity. The obvious remedy is to use a coarser grade of sand, or, provide extra vent channels in the present sand. Blacked cores will confer a smooth skin on a casting even if the sand is coarse. In the event that you are confined to the use of fine sand, you can secure immunity from core cutting by venting the cores with a wire or rod or even a sprue cutter 1-inch in diameter on the large sizes. Best method of venting the cores will depend on the style of coreboxes employed.

Q & A

Increase Coke Ratio

QUESTION

We require exceedingly hot metal, a temperature of at least 2700 degrees Fahr. at the spout and the best we can get so far is 2600 degrees. The iron is melted in a 64-inch diameter cupola with coke and iron charged 450 pounds of coke to 4500 pounds of iron. The first charge of iron on the bed is 6000 pounds. The cupola is in blast for 10 hours each day and an additional 200 pounds of coke is placed on every fifth charge to maintain the bed. A temperature reading is taken every 15 minutes and we find quite a variation.

ANSWER

You are to be congratulated in securing a temperature of 2600 degrees under the conditions outlined. The only way you can improve your practice to secure a higher temperature is to follow the example of the automobile foundrymen who employ comparatively small charges of iron and use coke in the proportion of approximately 1 to 6. In your case this would mean cutting out the double first charge of iron and using a uniform charge of 3000 pounds of iron with 500 pounds of coke. With this method of charging you will secure exceedingly hot iron. Also you will avoid the fluctuation of temperature which is inevitable under your present practice where the bed has to be boosted every fifth charge with an extra split of coke.

Q & A

Lack of Vent Is Cause

QUESTION

We are having trouble with small furnace legs 3 inches in diameter, 4 inches in length, cast four to a gate in a snap flask and molded on a squeezer. The patterns are mounted on a matchplate in such a manner that one straight core serves for two legs. We are attaching a free hand sketch showing the shape of the patterns and their position on the plate. The four castings are poured from a central sprue with a light gate entering each casting at the end. We use a dry sand core made from a mixture of sharp sand and a little river sand and bonded with oil in the proportion of one part oil to 40 parts of sand. We also add a little molasses water to the sand. These cores are made in halves and afterward are joined together with furnace cement. The castings contain blowholes in the cope side and in some instances show nothing but a shell. We shall appreciate your advice on how to secure satisfactory castings.

ANSWER

From the evidence submitted, particularly the sketch showing the position of the gates and core prints, it is apparent that the vent is not getting away from the cores. Several minor factors might be adjusted to advantage, but even under present conditions you will have no further trouble if you run a vent through the core and then scratch a vent in the joint of the mold back of each core print. In a straight core made from

your present mixture the vent might work its way through the sand, but the narrow neck at each end of the castings shown in the sketch restricts the free flow of gas.

A possibility exists that the coremaker scratches a vent channel in the joint of the core and then destroys it by smearing paste over it afterward. To offset this possibility he should place a small wire in the channel before placing the two halves together and then draw it out afterward. We suggest you omit both the molasses water and bank sand from the mixture. A straight sharp sand bonded with core oil will make the most satisfactory core.

The most satisfactory way to make these cores is to provide one split corebox and a number of dryer shells. The core is made as a unit, the top half of the core box is removed and replaced by the dryer shell. The assembly then is turned over and the bottom half of the box is removed, leaving the complete core in the dryer.

Q & A

Slagging Not Necessary

QUESTION

Is it necessary or desirable to skim a 48-inch cupola during the process of taking off a heat between 7 and 10 tons? The charge is made up of pig iron, 70 per cent and No. 1 cast scrap 30 per cent. The scrap is clean, but it is not milled.

ANSWER

If by a 48-inch cupola you mean a cupola 48 inches diameter inside the lining then the answer is that it is not necessary to remove the slag from the cupola, but it is desirable to add limestone to the charge to liquefy the ash from the coke and other impurities, so that it will flow to the well of the cupola instead of fusing in a viscous mass that sticks to the wall, retards melting and imposes extra labor on the cupola man the following day chipping it away from the lining. A 48-inch diameter cupola operated properly has a melting speed of between 9 and 10 tons per hour. The usual charge for a cupola that size, where hot iron is required for small castings, is 2000 pounds of iron and 225 pounds of coke. The average cupola will hold from five to seven charges. From the foregoing it is apparent that all or nearly all the iron is placed in your cupola before melting commences. Also the entire heat is poured in less than an hour. Under these conditions, the amount of slag formed will be small and may be allowed to remain in the cupola until the bottom is dropped. If necessary the heat can be melted without the addition of a pound of limestone or other fluxing material, but as previously stated, the lining will present a dirty mess in the morning and will require an hour or maybe two hours extra work on the part of the cupola tender in cleaning out the cupola and getting the lining in condition. This extra time costs money and should not be necessary.

In the event that by a 48-inch cupola we mean 48 inches inside the shell, then a different set of conditions is presented and the answer is that slagging the cupola is not only desirable, but actually necessary. With a single brick lining laid on edge the inside diameter of a cupola with a 48-inch shell is only 40 inches. With a double lining one brick on edge and one flat, the working diameter of the same cupola is only 36 inches. In the first instance the melting period would extend over 1½ hours and in the second instance the cupola would be in blast for over 2 hours. Unless the slag was drawn off during this prolonged period, it would seriously interfere with the efficiency of the cupola, reduce the melting speed and build a bridge above the tuyere line of the cupola.

MALLEABLE

Raise Manganese Content

QUESTION

We find that our iron is shrinking more than it did in the past and we are at a loss to understand the reason. This is more noticeable with light castings where there are heavy and light sections, and the shrink causes a noticeable weak spot in the castings. At present we are using 37½ per cent pig iron; 12½ per cent railroad malleable scrap and 50 per cent sprues. The analysis from hard iron shot taken about the middle of the heat shows 0.80 per cent silicon; 0.095 to 0.10 per cent sulphur; 0.168 per cent phosphorus; 0.22 to 0.25 per cent manganese, and 2.70 per cent total carbon. The range of silicon is from 0.80 to 0.90 per cent and the carbon from 2.50 to 2.80 per cent. In the past we did not use so much malleable scrap; sometimes none, and at other times 2½ to 5 per cent with approximately 50 per cent pig and 50 per cent sprues. While the silicon, phosphorus and carbon were about the same as at present the sulphur ran about 0.075 to 0.08 per cent and the manganese about 0.30 per cent or a little higher. Is the trouble due to low manganese?

ANSWER

Your manganese is low for the sulphur. We cannot say that your shrinkage troubles are due necessarily to this, but you also may develop annealing troubles. For the sulphur given, a manganese content from 0.30 to 0.35 per cent would be more in line with good practice. Some operators consider a high percentage of scrap as undesirable in itself. Scrap carries oxides in the form of rust, and oxidation is a possible cause of shrinks. We also suggest that you study the data given by H. A. Schwartz in a paper entitled, "Shrinkage in White Cast Iron" which was presented at the 1929 convention of the American Foundrymen's association, and is published in the *Transactions* of that association.

STEEL

Steel Castings Crack

QUESTION

What is the cause of cracks in steel castings produced in the electric furnace when an excessive amount of gates and heads is used in the charge? Chemical tests show the phosphorus and sulphur to be 0.045 per cent and under, and carbon, manganese, and silicon within the proper ranges. No change is made in the molding or core practice. If in the following heat, a smaller percentage of gates and heads are used, and a larger percentage of new scrap is added, the cracks will be eliminated. The resulting metal in each case is clean and proper shrinkage has taken place in the riser. The castings are solid.

ANSWER

It is scarcely possible that the cracks are caused by the use of the extra amount of heads and gates. They are due probably to some difference in the heats that you make when using the increased amount of scrap. In handling an electric furnace the charges should be, as far as possible, the same from one heat to another so that they can be handled in the same way and give the same melt-down composition, temperature, etc. without varying the practice to suit the nature of the charge used in the furnace.

Enough foundry scrap should be used in each heat to use up what is made each day. The proportion of fine material should be kept as far as possible the same, and the same amount of heavier purchased material should be used for each heat. Variations in the amount of rust charged in each heat due to the use of badly corroded scrap, should be kept to a minimum.

By so standardizing the materials charged, the composition and volume of the slag will be kept comparatively uniform so that the additions of ferroalloys needed will vary little, and the heats can be melted down and heated up in the same amount of time with a reasonable assurance that the steel in each heat will be of the the steel in one heat will be of the same quality as in the other heats.

Problems in Nonferrous Founding

By Charles Vickers

Bronze Contains Holes

We lately have learned that some of our phosphor bronze castings show tiny gas pockets in them just below the skin. These gas pockets are also noticeable at the juncture of the gate and the casting. Most of them are on the cope side. However, on bearing brasses they are noticeable on the drag. The mixture is 80 copper; 10 tin, and 10 lead to which is added 0.10 per cent of phosphorus, and we buy it ready mixed in ingot. We melt in a natural draft, coke-fired pit furnace in a No. 80 pot and it takes from 2½ to 3¼ hours to melt the first pot, and about 2½ hours for each succeeding pot. About 220 pounds of metal is melted in each pot. Is this melting time excessive? Charcoal is placed in the bottom of the empty pot and ingots, chips and gates are charged on top. As the heat progresses, additional charcoal is added as required. Are we introducing gas into the metal by this process? Quite often so much cold metal is charged into the pot that it projects above the top and also hangs over the sides of the pot in the direct path of the gases. Is this bad practice? Occasionally we have to pour a large casting which necessitates our melting in the crucibles and then transferring the metal to a crane ladle. This crane ladle usually has a deep layer of burning charcoal on its bottom so that when the metal is poured into it, it flows through this charcoal. Are we likely to gas the metal in this way?

Provided a ¼-inch cut will take out these gas pockets we would state that they are caused by the mold. That is, the sand is too close and should, therefore, be opened up by addition of a coarser grade, or it might be that in the case of plumbagoed molds that the coating was the source of the difficulty. The gases developed from contact of the molten metal with the skin of the mold have been unable to seep away through the sand, hence they had to remain in the metal. Such metal when poured does not lie quietly against the walls of the mold but simmers. This can be observed when a mold is so risered that by looking down the risers, the metal can be noted as it fills the mold. Such risers must be covered with isinglass, and it sometimes pays to make this experiment. In molding bearings, the necessity of venting the mound of sand that forms the bearing part usually is neglected. Such castings should be vented through the drag so that the gases can escape without being forced upward into the solidifying metal.

If the porosity extends deep into the casting, the metal has been gassed in the furnace. However, in this case there always is a tendency of the gases to coalesce, and thus produce large holes. The melting time is not excessive for coke-fired natural draft furnaces, but it is hopelessly out of date and lengthy when compared to modern methods. Placing charcoal in the bottom of the pots is only harmful when it is in large pieces and likely to get caught and held immersed in the molten metal. Then it will gas it. It is best not to put it in the bottom. Put hard wood blocks on top of the cold charge. Charging cold metal into the pot so that it projects above the top of the crucible is bad practice.

Also letting the cold metal hang over the sides of the pot is bad and also wasteful practice, for the furnace gets most of it. It is unnecessary too for the coke fired natural draft furnace has to have a flue, and this insures that the furnace is deep enough for a deepener to be used on the pots. In transferring metal to a large container burning charcoal in the bottom of the latter is a common condition. It keeps the ladle hot and as it floats on the metal poured in, it can do no harm. It does good as it blankets the fluid and so prevents oxidation. However, there is no sense in going to extremes with this practice, as would be the case when too thick a mass of charcoal is used. It is better to have about 3 inches of charcoal, and have it burning and red hot when the metal is poured in. One thing to remember is that immersed charcoal will give gassed metal, for it gives off carbon monoxide mostly, which is quite soluble in copper alloys. The gas and hydrogen given off by the action of molten metal on moisture are causes of porosity.

Q & A

Metal Separation Occurs

We are sending you one of our valves for you to inspect, and advise us what causes the metal to separate in the manner in which it does. We are using a mixture of 70 per cent copper; 24 per cent zinc; 3 per cent tin and 3 per cent lead.

We cannot tell you just what causes the metal to separate in the manner shown by the sample casting since no research work has been carried out on that problem. Therefore, while we can advance plausible theories for the phenomena, still they remain theories because they never have been proven facts by experimental evidence. We do know that yellow brass, and also red brass high in zinc, are addicted to this trouble. We firmly believe that in time this problem will be taken up by some investigator. Then a solution will be arrived at that will be helpful to the entire brass foundry industry and eliminate some of the guesswork.

In the meantime we suggest that a double gate be used on the castings and that it be made oval in section, that it be fed from an *A*-shaped runner in the cope. The runner should be an extra high one, in fact, as high as the top of the casting, or a quarter inch higher. It may look strange to you, but you are not getting them good now. It is not necessary for the high runner between the gates to be so high, so it can be shaped on the plan of a switchback railway. What we are aiming at is to feed metal to the casting to compensate for the natural shrinkage, and this has to be done from a supply of liquid metal external to the castings. Otherwise the castings will feed themselves and the lower part will be sound at the expense of the upper part, particularly in the case of alloys that solidify with small crystals, as the copper-zinc alloys invariably do when tin and lead is present in sufficient quantity to be alloying agents.

Bill Comments on High Hats and Spark Arresters

By Pat Dwyer

JUST between ourselves, Bill," I said the other night, "have you ever considered what you will do when you no longer are able or willing to work. To wipe the sweat out of the furrows and so forth."

"Well," Bill replied, "I have not quite made up my mind on that important point, but off hand and for first choice I think I'll retire to one of these here now lodges in the vast wilderness where I no longer will be pestered with your silly questions.

"What's the big idea?" he continued, suspiciously. "Don't tell me you have joined that nefarious brotherhood who prey on their innocent and helpless fellow citizens by badgering and bullying them into buying life insurance.

"If that is your little game, young-feller-me-lad, you can count me out right now, before you start your high powered, ready made solicitation featuring the fate of the 100 men who started out together from scratch, but who made such a sorry showing on the score board. If I remember correctly one of the names appeared on a winning ticket, but none of the others qualified either for place or show. I have heard this sterling story and all the other arguments 100 times, yes, 500 times and I can tell you before you start that I am prepared to say just one word, and that word is NO! Get that, me boy, just one plain and simple NO. Simply that—as old what's-his-name's raven said one time—simply that and nothing more." "You are in too much of a hurry," I hastened to assure him. "I have no intention of trying to sell you fire, life, plate glass, or, for that matter, any one of the other 57 varieties of insurance. Up to the present, so far as my feeble lights permit, I have tried to lead a harmless life, with charity for all and malice toward none and—er—all that kind of thing, if you take my meaning.

"Far be it from me at this late date to start a campaign of aggravation and thus risk losing all the friendships with which I have been favored over a period of many years. Pull in your horns and sheath the old claws. You are perfectly safe, so far as I am concerned.

"Among all the methods of earning a more or less honest livelihood, I don't mind telling you that trying to sell anything is the last one of the list that I would tackle. The ability to sell is a special gift vouchsafed to only a comparatively small number. I am afraid I was behind the door—"

"Probably asleep," Bill interrupted.

"Asleep or awake," I admitted, "the fact remains that the fairy overlooked me in distributing this special gift. I might claim that my shyness and modesty were to blame, but you, who have neither one nor the other would not appreciate such a nice point. However, that's neither here nor there. I am not a salesman, but I am not worrying.

"Furthermore—and that's a noble word—if dire necessity—dire is another word in the conjuring class—if dire necessity forced me into a corner where I was faced with the alternative of starving or attempting to sell some commodity, I would try anything and everything except life insurance.

"Dash it all, I'd get myself a tin horn, a horn with a particularly atrocious and piercing tone, and peddle fish—"

"You would be in congenial company, anyway," Bill grinned, "until some one hooked you for a sucker. That would be a nice end for a perfect day, hey? So long as your long beak remained in working, or in reasonably working order, you would know you were among your friends. That is one thing about the fish business that distinguishes and sets it apart from all others. It has what you might call an atmosphere peculiarly its own.

"Knowing you as I do, my own private opinion is that you would fall down on the job—literally and figuratively. Pushing a hand cart and blowing a long, tin horn at the same time is a job for a husky young athlete with muscles of steel and lungs of brass; a combination of Pan the piper and Hercules. Nice boys, both of 'em, but not in your class.

"Instead of a tin horn and push cart, you should get yourself a tin cup, and a small, melancholy dog, a remnant. Thus equipped you could pick out a nice sunny corner, wrap yourself inside an old sweater or shawl and let nature take its well known course. As a sincere friend and—er—well wisher, might I suggest that success in your future calling, avocation, sphere of activity, or whatever you choose to call it, will depend in a great measure, in fact I might say will depend exclusively, on the judgment you display in picking out the right kind of a dog. Do not make the mistake—alas, only

NOISE AND SMELL NEVER FAIL TO GET ATTENTION

too common among amateurs—of associating with a big, burly, hairy brute, constantly exposing a mouth full of long, sharp teeth. His disposition may be as mild as that of a kitten, but you never will have a chance to prove it. His friendly grin will be misinterpreted as a fiendish snarl by timid old ladies, kind hearted children and other softies, who otherwise might be inclined to contribute to your joint support. The average man will eye that kind of a brute askance and reflect that a man who willingly consorts with that type of menace by day, probably is a burglar, a yegg or a holdup man by night. He will tell the cop on the corner to keep an eye on you. You may consider yourself lucky if you are not carted or dragged off to the police station to have your finger prints registered. The dog you want is one that looks as if it had just been blown a mile and a half out of a quarry with a charge of dynamite. Preferably you should select one with only one eye, or, failing that, one with a pair of miss matched peepers. A disreputable cur with a hairless tail tucked permanently between its hind legs. One with large, bare areas between the few remaining tufts of hair on the jangling chassis. Get one with a perpetual shiver—you know, the quaking aspen type—and if you can teach him to cough, so much the better. You can secure the proper emaciated and hang dog appearance by neglecting to feed him, by keeping him on a flapper diet, by muzzling him when off duty, or by slipping a few assorted lengths of tape worm in his initial dish of spaghetti.

"There y'are," Bill concluded handsomely. "Given a dog designed, constructed, erected and operating as per above schedule, your success is assured.

"I don't want to rush you to a decision, or to appear unduly importunate, but in view of this invaluable collaboration on my part, don't you think I am entitled to—let us say—a 50-50 split on your earnings, if any?"

"Bill," I said, "I have been accused of many things at one time or another, during my pilgrimage through this well known vale of tears. Up to the present, no person ever has had reason to accuse me of ingratitude, of biting the hand that fed me. No, not even when I have been fed on tripe. I deeply appreciate your interest in my future welfare. I'll see you and go you one better. A 50-50 split is not sufficient. I'll give you the dog!"

"Speaking of dogs," Bill remarked, skipping characteristically from one subject to another. "I see by the papers lately that we had an exceedingly narrow escape from having the loose limbed and husky dogs of war unleashed and sent baying through one of our southern sea ports. A cutaway coat and a plug hat were all that saved us from or that stood between us and the bow-wows."

WHICH SHALL IT BE, BRAZEN BLOND OR DEMURE BRUNET?

"Interesting if true," I admitted. "However, I am glad to learn that at length some person or persons found a real use for these fantastic garments. What did these patriotic citizens do? Feed the hat and the rest of the rig to the dogs?"

"No," Bill replied judicially. "They did not exactly feed these garments to the dogs, at least not literally, but in a figurative sense the gesture amounted to practically the same thing.

"The only really important fact is that the caroline hat, the claw hammer coat and—I believe—a pair of striped trousers, not pants, mind you but trousers, kept this land of the free and home of the brave out of what might have developed into a hot scrap, a war of major dimensions."

"Tell me one thing," I implored Bill. "Before going any farther on this vicious and sanguinary war trail, tell me this. By any chance was there a human being inside these clothes on this momentous, not to say epochal occasion to which you just referred?"

"Now that you raise the point," Bill replied, carelessly, "I believe the garments were more or less inhabited at the time, but that was a mere incidental detail. The clothes are what did the trick.

"Down in a certain southern seaport the people no longer talk about pouring oil on the troubled waters. That simile is passe. The favorite old slogan 'Kitty, bar the door' has given place to 'Oh! Paw, jump into the old cutaway!'

"Among ordinary human beings, a rose by any other name may smell as sweet and a man may be a man for all that, but these here now dogs of war are more fastidious, or it may be they never heard of the sterling principles laid down by the late Mr. Shakespeare or the—in some respects — equally famous and more recent Mr. Burns. The sight of a pair of pajamas sets them—the dogs, not the poets—straining at the leash, but the sight of a long tailed coat knocks all the fight out of 'em. Sends them whimpering off to their kennels." "I may be wrong," I said, "but I always have been under the impression that the majority of wars, big and little, originated in places where long tailed coats were more in evidence than pajamas. However, with your permission, that point respectfully may be referred to the League of Nations. Let them fight over it. What about this war on near war you discovered recently?"

"Don't you ever read the papers?"

"Hardly ever," I admitted. "What's the use?"

" 'Pon my word," said Bill, "I believe that story of the dumb maid servant is true."

"What story? Also why bring that up?"

"Listen, and you'll hear for yourself what kind of company you are in. A visitor at the one and only hotel in a remote little town, constantly marvelled at the lack of general knowledge displayed by an otherwise comely little maid. She had beautiful eyes, like those of a well trained Jersey cow and in a general way displayed just about as much intelligence as one of these gentle and undoubtedly useful creatures.

"Exasperated in his attempts to secure anything like an intelligent answer to any of his questions, the guest asked her if she knew the

Civil war had come to a close.

"She shook her blond curls apologetically.

"'I ain't seen a paper,'" she said, "since I came down to this poky little hole in the wall, the first of the summer. The hicks down here don't know nothin'. I don't believe none of 'em don't even know the war has started. I ain't heard none of 'em mention it!"

"You must pardon me," I said, "if I fail to follow you. Are you trying to tell me that a cow and a milk maid started the Civil war and a suit of clothes stopped it?"

"No," Bill explained patiently, "I'm not. I was just trying to tell you—Oh, what's the use—here, listen while I read to you the thrilling account as it appeared in all the papers.

GOVERNOR SAYS HE DID NOT KNOW HOW TO DRESS

A formal apology by the governor to the commander of a European cruiser, has ended a 24-hour diplomatic crisis which resulted from the governer's choice of a pair of green silk pajamas as attire in which to receive a call from the commander and his staff. A red and blue dressing gown nd blue bed room slippers completed the governor's attire. The naval officers came attired in dress uniforms. 'The governor's raiment was an insult,' the commander asserted after the reception. His boat would weigh anchor and steam out of the port unless an apology was offered, he asserted.

The governor hastily borrowed articles of formal morning attire from friends. The harbor boat was ordered and he returned the commander's call and presented his apologies. The governor explained that he came from a mountain district and was not versed in the niceties of diplomatic behaviour. He had treated the visitors 'Just like folks' and was surprised they had resented it.

'I wore the $35 lounging robe given me by the state banking department for Christmas—What more did they want?' He asked a friend.

"So far as I can see," Bill remarked as he folded the paper, "only one little touch was missing. The governor should have imprinted a large moist kiss on the scowling brow of the touchy commander. Then it would have been a case of Kitty, bar the door!

"Of course my advice has not been sought in this important diplomatic tangle, but I would suggest that if and when the next war ship steams into his harbor the governor retire to his villa in the country. The visitors then could pay their respects to the long coat and the plug hat propped up on a stick in the official chair ship shape and Bristol fashion!

"Talking about plug hats," Bill continued, "reminds me of an inquiry I had one time from a man who was contemplating erecting a spark arrester on his cupola. He said he was operating a cupola in close proximity to a plant where inflammable paints and varnishes are employed extensively and where flying sparks from the cupola stack constitute an imminent hazard. He wanted to know where and how he could secure a spark arrester that would give satisfactory service over a reasonably long period.

THE GUEST PICKS UP A LITTLE INFORMATION

"During the greater part of the heat while the cupola is filled to the charging door with coke and iron, neither sparks nor flame appear at the top of even a short stack. When no more new material is thrown in and when the stock sinks a few feet below the door, the flame commences to break through and mount higher and higher as the stock sinks lower and lower, thereby offering less resistance. An experienced melter by observing the volume and color of the flame can determine closely the amount of material remaining in the cupola as the heat draws to a close. In many foundries no attempt is made to check the blast toward the close of the melting period, although a moment's reflection will show that a full volume is not required when the cupola is nearly empty and at a high temperature. Where this feature is taken into consideration and the blast reduced, the flame at the top of the stack is almost negligible and no sparks are thrown out.

"Various types of spark arresters are available and have been applied to cupolas located in congested districts in compliance with rules drawn up by the local fire department. I have no statistics on the active life of any of these hoods or screens, but so far as their efficiency is concerned, it is significant to note that for years, have seen no reference to a fire caused by sparks from a foundry cupola. If he writes to the maker of his cupola, or to any cupola manufacturer whose name is listed in the advertising pages of THE FOUNDRY, he will discover a willingness to cooperate if necessary on the construction of a special spark arrester to meet the special conditions. In several European countries the practice is fairly common of covering the top of the cupola stack and directing the flame, smoke and sparks through a horizontal connection into a fairly large chamber provided with a small smokestack. The flame expands in the chamber and loses its force, intensity and temperature. The spent gas passes harmlessly up through the small stack while dust and small particles of coke fall to the bottom of the chamber and are removed through a suitable trap at periodic intervals. The same general idea is exemplified where attempts have been made to utilize the heat from the spent gas in raising the temperature.

When the A. F. A. Was Young

THE group picture reproduced on the opposite page might be characterized as the cradle likeness of the American Foundrymen's association. This group was made during the first meeting of the association held in Philadelphia May 12, 13 *and* 14, 1896. *The small inset in the upper corner is reminiscent of the shad dinner at Washington Park of which* THE FOUNDRY *for June,* 1896 *says:*

"After having their photos taken again in a group, dinner was served to as hungry a lot of foundrymen as this country has ever seen and it was thoroughly enjoyed."

This interesting photograph, one of the few prints extant, was loaned through courtesy of J. S. McCormick, J. S. McCormick Co., Pittsburgh.

The FOUNDRY
Family Photograph Album

The First A.F.A. Convention
Philadelphia 1896

HINTS FOR THE CORE ROOM

(Continued from Data Sheet No. 810)

that in any casting where the temperature of the core is raised high enough to destroy the bond before the pouring is completed or the metal is solidified, cutting and burning in is to be expected.

Sands, clays, and other constituents of cores and molding sands may fuse or vitrefy at a temperature considerably below their ordinary fusing point because of the pressure created in a mold as a result of the weight and velocity of the metal itself and the gases generated during pouring.

Blows and scabs against core surfaces usually indicate either too hard a core or too fine a sand which prevents the proper venting of the core. If the metal lays on a core quietly but burns in, the sand is suitable but the core must be given a coating of some kind.

Venting Problems

Wax vents are generally not necessary with clean open sands.

Coke and cinder centers for large cores will aid venting and hasten baking. They also greatly aid in the removal of the core from the casting.

The permeability of cores depends on the openness of the sand, the moisture content, ramming, and the thoroughness of the bake.

Miscellaneous Properties

A small amount of kerosene (1 to 200) in the sand mixes greatly helps to overcome sticking in the core boxes.

A small amount of corn flour (1 to 100) added to any core mix also greatly aids in overcoming sticking to core boxes.

Sticking to core boxes and driers often is caused by too much moisture.

When a core is dipped or sprayed with a wash, any part on which a coating is not desired can be brushed first with a dry parting and the wash will not stick to it.

Cores to be subjected to excessive heat or a longer bake than actually necessary may be sprayed with water before putting in oven. The heat and time required to evaporate this extra moisture will prevent the burning of the core.

Oil sand mixes made with an open sand are often difficult to strike off level, especially in shallow boxes. The sand seems to drag and it is necessary to slick the box full or bed the plate on to prevent a shallow or sagged core. Some have resorted to a hot *strike-off* to overcome this difficulty. This prevents dragging and gives a full core with the minimum of effort. The strike-off is made with a wooden handle

(Concluded on Data Sheet No. 812)

HINTS FOR THE CORE ROOM

(Concluded from Data Sheet No. 811)

and a steel face and this is kept on a hot plate convenient to the coremaker.

Formula for making hard sand matches consists of 15 pounds of fine molding sand, 1 quart of boiled linseed oil, and 4 ounces of litharge. Mix the litharge and sand before adding the linseed oil. Make up the match in the ordinary way, carefully securing all the frail edges, and then bake thoroughly in the core oven.

Organic matter (pieces of wood, coal, coke, saw dust, grass, etc.) on the surface of a core or mold will cause pits in the casting.

Dry sand driers can be made at comparatively little expense for certain jobs in many places where the expense of iron driers would not be warranted. Fit a baked core into the corebox and build a wood frame around the core and box so that an ordinary flat plate can be used on the top side. An extra hard core made in the frame can be used as a dry sand drier.

Dust, soot, etc. on cores for brass are detrimental to a smooth clean finish and increase the necessity for buffing and polishing.

Sands between 60 and 80 mesh are used most extensively for core purposes.

The effect on the strength of a core of variations in the baking temperature and time is too often overlooked. This is shown clearly by the results obtained on cores made from a linseed oil mix with an open, clean, silica sand. Test cores 1 inch square were broken transversely on knife edge supports 6 inches apart. Sand and binder were mixed carefully and 4 per cent tempering water was used throughout the tests.

Oven Temp. Degrees Fahr.	Bond to sand ratio by volume					
	1-50	1-60	1-70	1-80	1-90	1-100
	Transverse strength in pounds and ounces					
350	27-14	25-5	23-0	12-8	10-6	9-10
400		44-10	33-2	30-7	25-10	23-12
450	54-7	51-8	48-4	45-7	43-8	38-14

Tests made at temperatures above 450 degrees Fahr. showed a falling off in strength.

The rate of drying (baking), the moisture content, the mesh size of the sand, and the method of mixing are known to affect materially the strength of the core, yet little specific data seems to be available. A research along these lines would be of great value to the foundry industry.

THE FOUNDRY DATA SHEET, MAY 1, 1930
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

GRAY IRON

Possesses

Valuable Engineering Properties

Part IV

IT HAS been known for many years that some permanent deformation results on application of even slight stresses to gray cast iron. If loading is repeated the permanent deformation increments become less, and ultimately tend to approach zero for certain loads. That is, cast iron tends to behave more like an elastic material after several applications of stress. To illustrate this phenomenon, examine Figs. 27 and 31. The curve *A* in Fig. 31 represents one-half of a broken transverse bar which has been machined, then broken in tension. The other end of the bar was machined and stressed to 16,500 pounds per square inch giving the unbroken line *NO*. The load gradually was removed and the extensometer readings noted. The dotted line *OP* represents the stress-strain curve when removing the stress. When all the load was removed the permanent deformation was apparent. All the total deformation after a series of tests was checked carefully by a dividing engine. The loop *NOP* is the hysteresis loop of stress deformation, representing work done in overcoming the internal friction of the metal crystals, which has resulted in deformation. On repetition of stress shown in curves *C*, *D*, and *E* the values X_1, X_2, X_3 become smaller as there is less permanent deformation.

In case of steel a quite different condition is met as shown in Fig. 27. On the initial stressing the curve is practically a straight line up to the elastic limit. A large number of restressings well under the elastic limit produce no marked permanent deformation. (This test must not be confused with fatigue tests.) On breaking the bar after restressing, the curve is quite similar to that of a test piece previously unstressed. Referring to Fig. 27 it may be noted that the restressing apparently did not increase the modulus of elasticity as compared to the unstressed bar. The curve for single stress and for repeated stress under the elastic limit are quite similar.

In the tests on cast iron it was suspected that the values shown were above any real elastic limit. Further, the restressing load was too high a percentage of the initial load to be representative of stresses anticipated in engineering practice. Nevertheless it was decided to run similar series of tests, restressing more times and taking the complete stress-strain curve to rupture after the series of restressings had been completed. This second series showed some surprising results and confirmed the suspicions

Repeated Stresses

MANY times it is useful to know the effect of repeated stresses on an engineering material. While considerable investigation on this subject has been carried out on steel, gray iron has not fared so well. In the case of gray iron, the loads applied in repeated stressing have been much higher than ordinarily would be found in engineering practice which placed gray iron in a poor light. To clarify the subject, some further data is presented in this article which is the fourth of a series on the engineering properties of gray iron. Previous articles in this series have appeared in the Feb. 1, March 1 and April 1 issues of THE FOUNDRY.

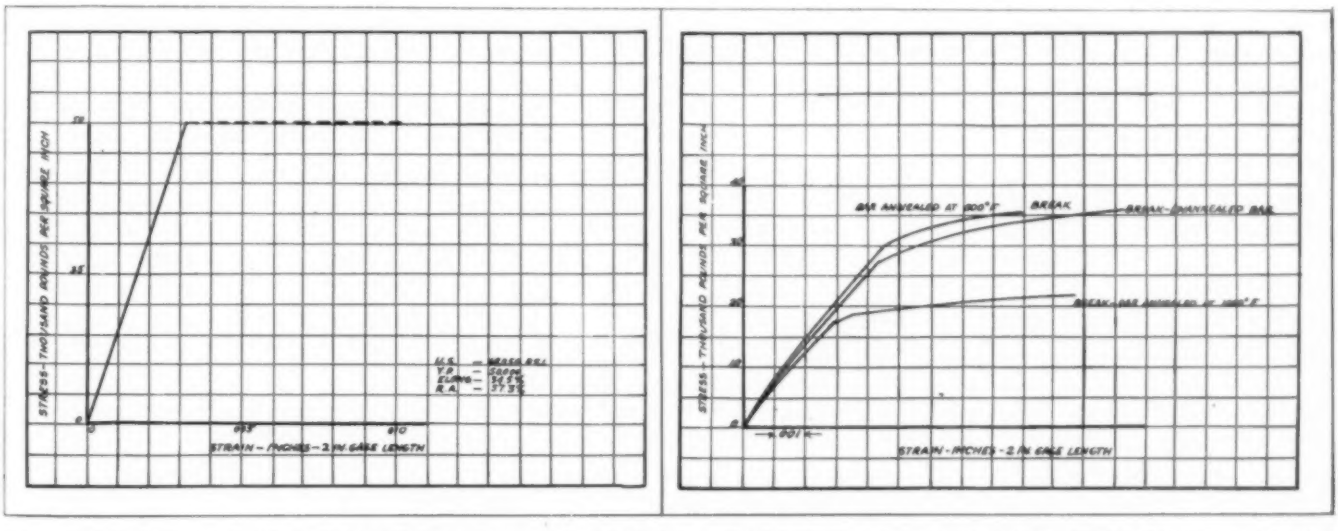

STRESS - THOUSAND POUNDS PER SQUARE INCH
STRAIN - INCHES - 2 IN GAGE LENGTH
STRESS - THOUSAND POUNDS PER SQUARE INCH
STRAIN - INCHES - 2 IN GAGE LENGTH

FIG. 27—TENSILE TEST ON HOT ROLLED STEEL AFTER STRESSING 25 TIMES TO 75 PER CENT OF THE YIELD POINT LOAD. FIG. 28—TENSILE TESTS ON CAST IRON AFTER STRESSING 25 TIMES TO 75 PER CENT OF THE MAXIMUM TENSILE STRENGTH

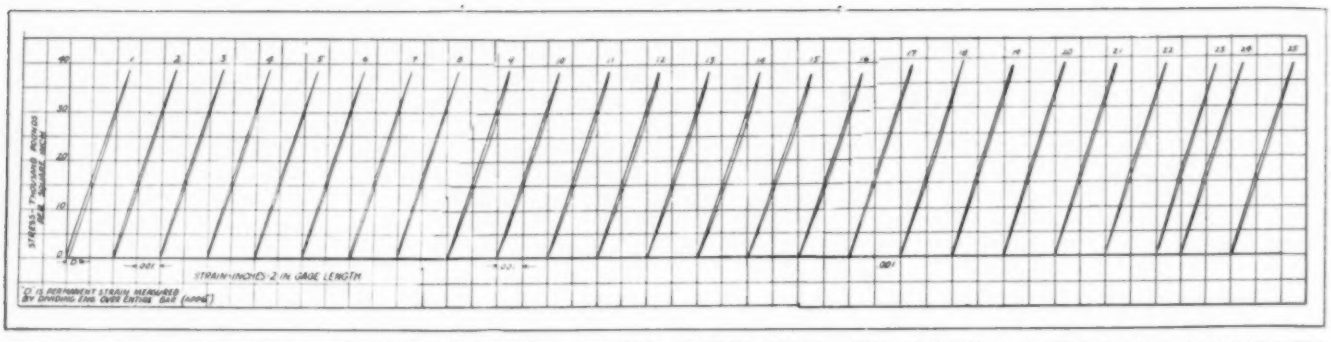


FIG. 29—SHOWING THE EFFECT OF REPEATED STRESSES ON HOT ROLLED STEEL. THE NUMBERS ON THE CURVES INDICATE THE ORDER OF STRESSING

about the position of an elastic limit.

The material chosen for the second series of tests was an iron containing 3.25 per cent carbon, 1.90 per cent silicon, 0.25 per cent phosphorus, 0.60 per cent manganese and 0.075 per cent sulphur. As cast it possessed a nearly pearlitic matrix. Several bars were cast 1.25-inch in diameter and treated as follows: Series 1—stressed to 75 per cent of its ultimate strength in the *as cast* condition; Series 2—stressed to 75 per cent of its ultimate strength after normalizing at 800 degrees Fahr.; Series 3—stressed to 75 per cent of its ultimate strength after an anneal at 1600 degrees Fahr.

Results of these tests are shown in Figs. 30, 32 and 35. The total permanent deformation as measured by a dividing engine and by an extensometer in the 2-inch gage lengths after 25 stress application are:

Series	Dividing Engine inches	Extensometer inches
1	0.0020	0.0021
2	0.0028	0.0023
3	0.0028	0.0029
Steel	0.0005	0.0005

As shown in Fig. 28 the final complete stress strain curves are quite different in character than ordinary tensile stress strain curves for cast iron. These curves obtained after subjecting the material to repeated stresses, resemble curves obtained with bronze in that there is a definite elbow or sharp change of direction in the curve. This probably is a definite elastic limit or yield point. These points in percentage of the ultimate strength before repeated stressing as determined from data obtained from the check bars are for: Series 1—82 per cent; Series 2—81 per cent, and Series 3—80 per cent. The close relationship in percentage of the apparent elastic limit to ultimate strength for these differently (heat) treated bars is remarkable. The stress applied evidently caused some deformation, yet the strength is not increased as is the usual case in steel stressed above its elastic limit. Cold working was limited, and possibly incipient fracture exists. The results obtained are as follows:

Series	Break restressed bar	Break check bar	Per Cent Difference
1	36,250	34,550	4.69
2	36,010	38,000	5.23
3	21,750	22,500	3.34

It is particularly to be noted that there seemed a small increment of deformation for nearly every loading at this stress percentage.

The same test was repeated on another untreated bar decreasing the stress to about 55 per cent of the ultimate strength. The results on this

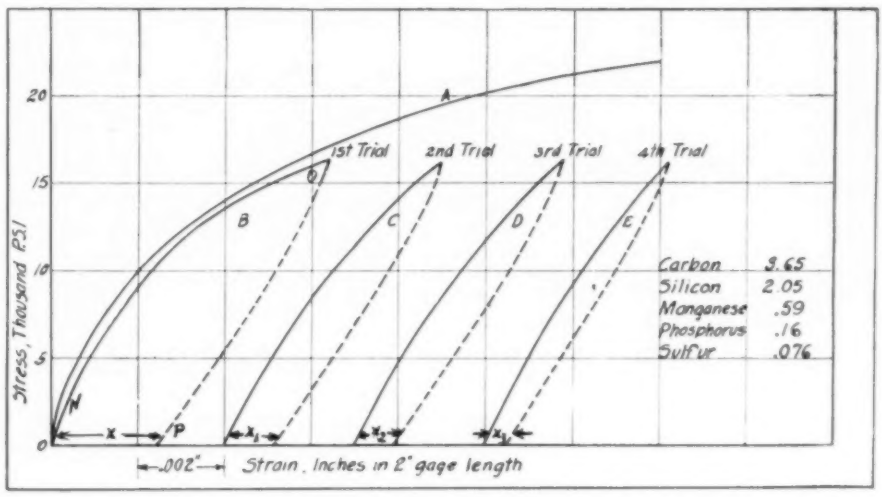


FIG. 31—EFFECT OF STRESS REPETITION ON CAST IRON. THE BARS WERE 1.20-INCH AS CAST AND MACHINED TO 0.505-INCH. *A* INDICATES THE ORIGINAL BAR STRESSED TO RUPTURE. *B. C. D* AND *E* SHOW THE SECOND BAR STRESSED TO 75 PER CENT OF THE FIRST

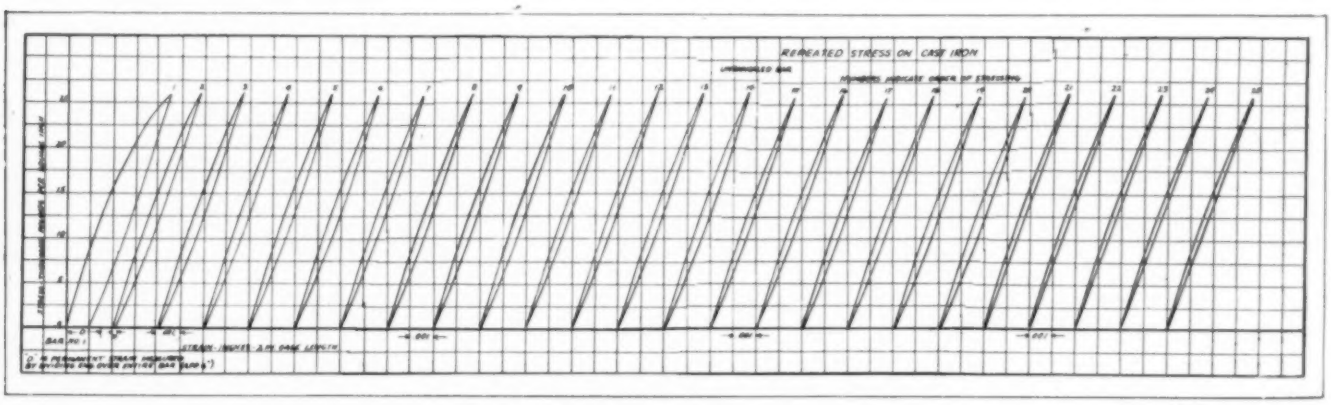


FIG. 30—EFFECT OF REPEATED STRESSING ON CAST IRON. THE BAR WAS UNANNEALED AND THE NUMBERS INDICATE THE ORDER OF STRESSING

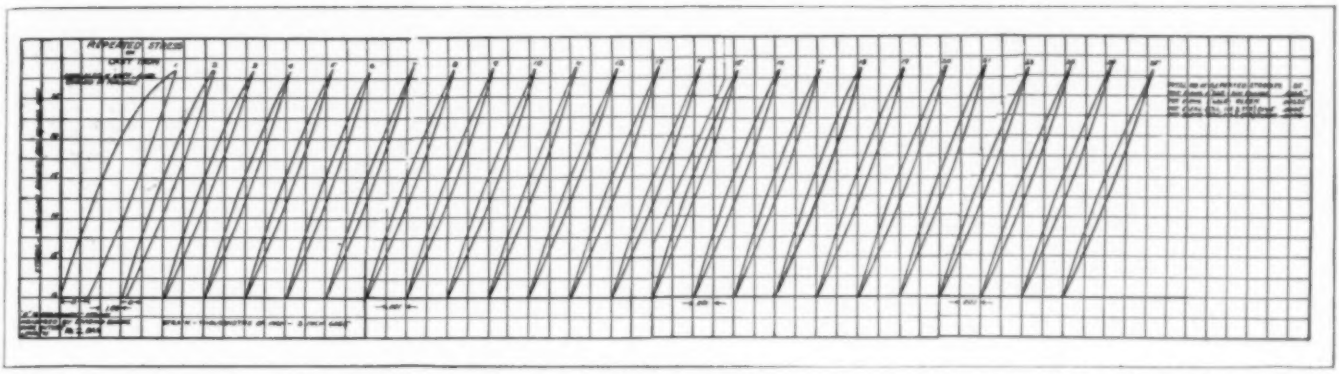


FIG. 32—REPEATED STRESS ON CAST IRON. THE BAR WAS ANNEALED FOR 4 HOURS AT 800 DEGREES FAHR. AND COOLED IN THE FURNACE. THE NUMBERS INDICATE THE ORDER OF STRESSING

series are shown in Fig. 37. After 25 stresses the total permanent elongation (deformation) was 0.00065-inch in the 2-inch gage length. Although marked stiffening is evident, comparison of the complete stress strain diagrams of the previously stressed and unstressed bars Fig. 38, shows on straight line and definite elbow in the stressed bar stress strain curve as was the case in series shown in Fig. 28.

Quite recently J. T. MacKenzie in the *Proceedings* of the American Society for Testing Materials, 1929, recounted the work of various investigators. The work as presented is confined largely to transverse tests. The relative shifting of the neutral stress axes due to both differences in section sizes and different compositions does not allow accurate interpretation of the results. Furthermore, the proportionate load (about 75 per cent) chosen for each set may or may not be above elastic limit for the material. However, MacKenzie found that in a series of 373 transverse loadings there was no appreciable change in set after the twelfth load, on a bar containing 2.27 per cent total carbon and 2.46 per cent silicon, the metal having an ultimate modulus of rupture of 61,000 pounds. The stress applied was equivalent 45,000 pounds modulus of rupture, or about 70 per cent if it were possible to assume uniform stress center of gravity. MacKenzie arranged a chart which will be presented in Section V as Fig. 40. This chart indicates that the set after six readings diminishes with decrease in graphite content, as also is shown in Figs. 27 and 31. He suggests that a large part of the set is due some crushing of the graphite flakes, or to squeezing of iron grains into the flakes surrounding them. Somewhat similar mechanism to account for the set was proposed by Upton in 1916. The set noted by MacKenzie is the sum of "set," slip and incipient fracture. Some practical conclusions which may be derived from the various investigations are as follows:

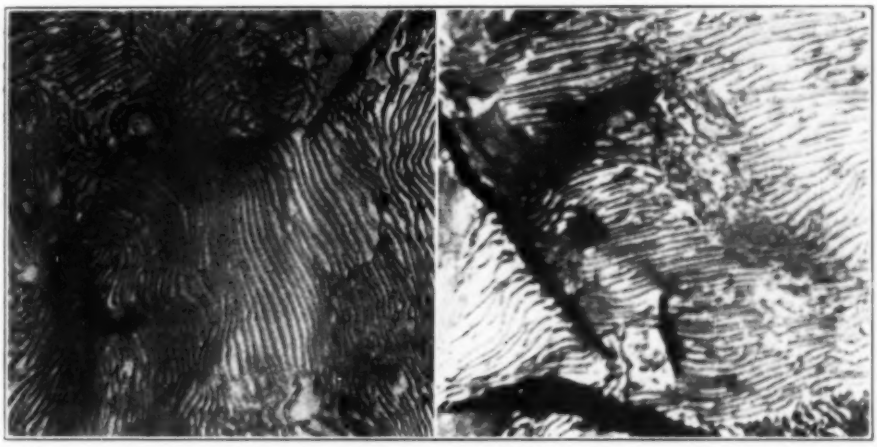


FIG. 33—PEARLITE IN UNSTRESSED BAR CONTAINING 3.25 PER CENT CARBON AND 1.90 PER CENT SILICON AS CAST. 2000 DIAMETERS. FIG. 34—PEARLITE IN BAR RESTRESSED 25 TIMES TO 75 PER CENT OF THE ULTIMATE STRENGTH. 3.25 PER CENT CARBON AND 1.90 PER CENT SILICON. 2000 DIAMETERS

The permanent set taken by cast iron when first loaded soon approaches zero, providing the loads are not too great a percentage of the ultimate strength. The exact maximum loads above which continued applications of stress would result in failures must be determined by creep or flow tests. The presence of permanent deformation on initial stress indicates loss of energy, hence the work done. On the other hand Moore and Lyon, and later

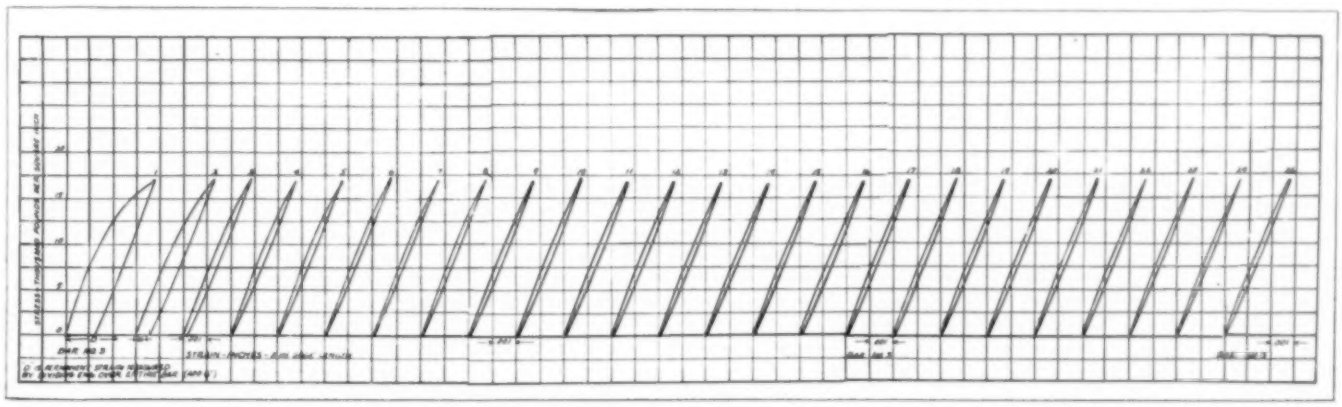


FIG. 35—EFFECT OF REPEATED STRESS ON CAST IRON. BAR ANNEALED FOR 4 HOURS AT 1600 DEGREES FAHR., AND COOLED IN THE FURNACE. THE NUMBERS INDICATE THE ORDER OF STRESSING

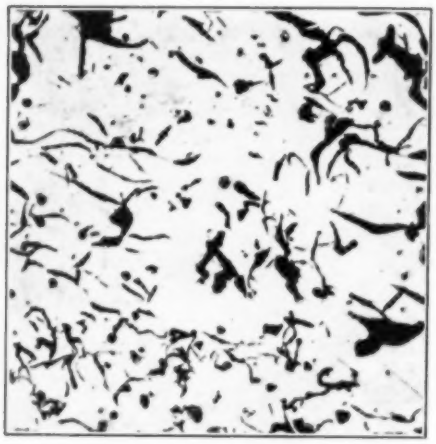


FIG. 36—STRUCTURE OF UNSTRESSED BAR ANNEALED AT 1600 DEGREES FAHR. 100 DIAMETERS

Kommers, have shown that under repeated alternating stresses (fatigue test) cast iron will hold up indefinitely at stresses approaching and in some cases exceeding one-third of its ultimate strength. This will be discussed more in detail in the section on fatigue strength of gray iron.

Where slight initial permanent deformation at intermediate loads is objectionable, cast iron members must be designed quite heavy. This applies to loads which may be only 10 per cent the breaking strength of the casting. Where an initial stress can be applied before final fitting, the weight of the supporting member need not be so heavy.

Neither normalizing gray iron at 800 degrees Fahr. nor annealing it at 1600 degrees Fahr. decreases the deformation on initial loading. As a matter of fact, on the samples examined, they increase it. The advantages derived in retained constancy of dimension when machining after normalizing treatment are due to stabilization of internal stresses as will be explained later in more detail.

No simple and accurate explanations of the exact internal mechanisms underlying these unique elastic phenomena of gray cast irons have been advanced. In most metals first application of stress results in some distortions of the crystal lattices particularly those of the more continuous components. If the stress is low enough the interatomic forces are sufficient to bring about readjustment of the crystals, consequently no permanent distortion occurs, even on repeated stressing. If the limiting stresses are exceeded, the slip separates the atoms so far that they are unable to regain their former positions. This results in crystal distortion, and on continued and increased application of stress, rupture occurs.

When most alloys are stressed within their respective elastic limits no alteration in structure should be expected. However, when stressed above the elastic limit (with subsequent permanent deformation) the results of such cold working are apparent in

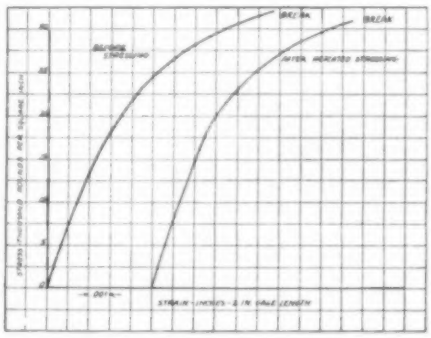


FIG. 38—TENSILE TESTS OF CAST IRON BEFORE AND AFTER REPEATED STRESSING TO 55 PER CENT OF THE ULTIMATE STRENGTH

altered microstructure. For example, if a broken steel tensile specimen is examined, grain distortion is quite apparent. At lower stresses grain distortion may not be apparent but, in plastic components such as ferrite, slip bands often are distinguished even after polishing and etching.

Bolton and Weigand have examined the restressed and broken cast iron bars used in the experiments mentioned. After most careful study of

FIG. 39—STRUCTURE OF BAR RESTRESSED 25 TIMES. ANNEALED AT 1600 DEGREES FAHR. 100 DIAMETERS

sections of these bars, at magnifications up to 5000 diameters, they have been unable so far to find any appreciable microscopic evidences of distortion within the components of the materials. This does not mean that there is no such distortion, as the mechanical tests are ample evidence of the same. In Figs. 33 and 34 are shown pearlite structures in restressed and unrestressed bars respectively. The magnification is 2000 diameters. The specimens were etched to show the pearlitic structure of the matrix. Fig. 33 is the unstressed bar and Fig. 34 the restressed bar. To show the graphitic structure in the two types of bars, other micrographs were taken. These are shown in Figs. 36 and 39. The specimens are unetched and the magnification of each is 100 diameters. Both specimens are from bars annealed at 1600 degrees Fahr. Fig. 36 is the unstressed bar while Fig. 39 is the restressed bar. Microscopic examination did not reveal any evidences of distortion or incipient fracture. Therefore, it is believed that the distortions are too minute to be detected easily by microscopic methods. Consequently, the nature of the changes must be explained by deductive reasoning.

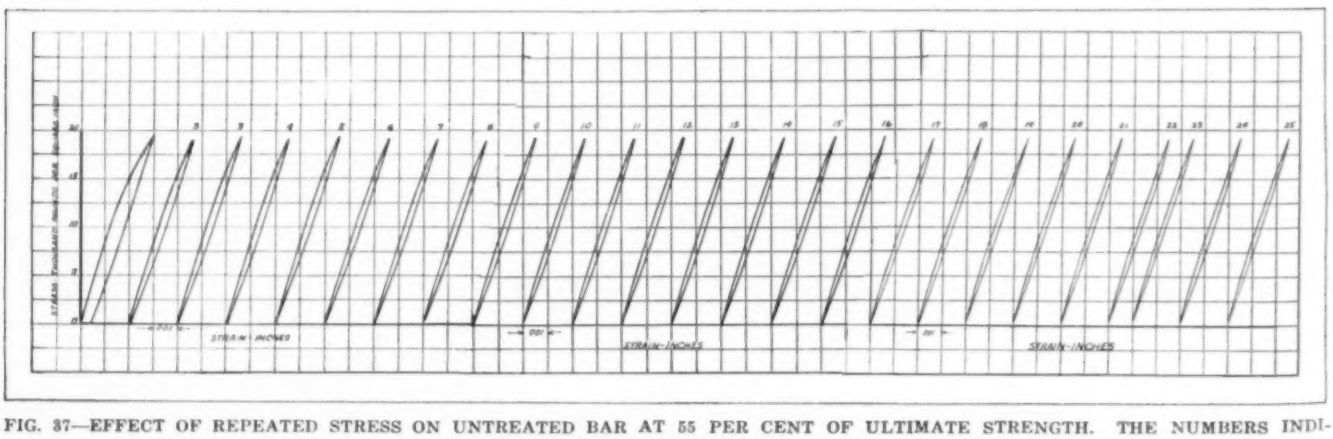


FIG. 37—EFFECT OF REPEATED STRESS ON UNTREATED BAR AT 55 PER CENT OF ULTIMATE STRENGTH. THE NUMBERS INDICATE THE ORDER OF STRESSING

Cleveland Foundries Supply Castings

(*Concluded from Page* 173)

tion basis. Many ingenious devices have been developed for molding, gating and pouring these castings, also for the prevention of cracks, draws, shrinkage and segregation.

The foundry of the Westinghouse Electric & Mfg. Co., at the foot of West 58th street, makes a diversified line of small and medium weight gray iron, brass and aluminum castings for several of the assembling plants of the company.

The South Bend, Ind., plant of the company now is being moved and combined with the Cleveland works. Headquarters of the lighting division of the company will be located in Cleveland. This division makes street lighting equipment, airport lights, exterior and interior lights of all kinds. At present an extensive sand and mold conveyor equipment is in process of installation to handle approximately 75 per cent of the tonnage. The present output is approximately 750 tons of gray iron and 30 tons of nonferrous castings per month.

Under the direction of the veteran Ben D. Fuller, a graduate of the Pittsburgh plant of the company, also a past president of the American Foundrymen's association, the Westinghouse Co., continued for many years to handle a line of heavy castings at the Cleveland plant. During the war years an extensive malleable foundry was erected and placed in operation for the manufacture of hand grenades.

The Crucible Steel Castings Co., located on Almira avenue opposite West Eighty-fourth street produces from 18 to 24 tons of jobbing steel castings a day in plain carbon and alloy steels. As the name indicates, the firm originally used the crucible process for making the steel, and was established in 1909 by H. L. Aiken.

In 1916 the firm installed an electric furnace and thus has its name emblazoned on the honor roll as being one of the first steel casting companies to employ that type of melting unit. In 1922 the foundry was moved to its new location on Almira avenue.

Castings are made in either green or dry sand as required. The same oil-fired oven is used for drying molds and cores. One of the features of the foundry is the close control of the sand used for molding. The sand is handled in batches and each batch is tested for moisture, permeability and bond strength. The firm has two electric furnaces with capacities rated at 1½ and 1 ton. The usual quantity melted in the 1½-ton furnace is 6000 pounds. The alloy steel castings are used in road building machinery and crane equipment. About one-third of the daily production is alloy steel. The castings range in weight from 3 ounces up to 5000 pounds.

Rapid growth of business induced the Gluntz Brass Foundry Co., about a year ago to move from its former location on East Fifty-fifth street to the present commodious plant at 10803 Harvard avenue. Practical experience gained through many years as molder and foundry superintendent is reflected in the manner in which the plant has been equipped and is operated under the direction of Dan J. Gluntz, one of the proprietors. Castings are made in wide variety in practically all nonferrous metals. The company maintains its own pattern shop and has developed many ingenious shop kinks in the construction of patterns for rapid and economical production of castings.

Forest City-Walworth Foundry Co., established in 1890, operates three foundries with headquarters in the plant at 2488 West Twenty-seventh street. In addition to miscellaneous light and medium weight gray iron castings, usually handled in large lots, the company manufactures hot air heating furnaces and accessories. The lighter castings are made in the usual manner on benches and squeezer type molding machines. Special equipment including iron flasks and elaborate pattern equipment has been installed for the manufacture of the various heavy furnace sections.

Marked economies and increased production have been secured by molding two upper or lower middle sections of the furnace in a single flask, instead of singly as formerly. The patterns are mounted nose to nose and the two molds are separated by a comparatively narrow margin where the cope sand touches the sand in the drag. The castings are poured simultaneously with two ladles, one at each end of the flask. The metal enters the mold at the bottom through a series of shallow gates connected to an encircling runner.

Typical malleable practice is exemplified at the plant of the Lake City Malleable Iron Co., 5046 Lakeside avenue, formerly known as the Chisholm & Moore Malleable Iron Co. plant. Melting equipment includes three 20-ton air furnaces, one of which is fired with powdered coal. The other two are hand fired in the usual manner. Castings are made for a wide range of industrial uses including the railroad and automotive field.

Announce Visitation Schedule

Allyne-Ryan Foundry Co., Aetna road and East 91st street, gray iron, automobile and diesel engine castings, two 84-inch cupolas.

Cleveland Co-operative Stove Co., two plants, one at Central avenue and East 67th street, the other (new) at 2800 Harvard Ave., gray iron, stoves, furnaces, four 84-inch cupolas.

Crucible Steel Co., Almira avenue and West 84th street, small and medium weight carbon and alloy steel castings, one 1½-ton and one 1-ton electric furnace.

Ferro Machine & Foundry Co., East 66th street and Hubbard avenue, gray iron, automobile and pump castings, three 72-inch cupolas.

Forest City Walworth Run Foundries, three plants with executive offices at 2488 West 27th street, gray iron, miscellaneous light castings, stoves and furnaces, three 48 and three 54-inch cupolas.

Gluntz Brass Foundry Co., 10803 Harvard avenue, general jobbing in brass, bronze, aluminum, white metals and nickel, open flame and crucible furnaces.

Kilby Mfg. Co., 4623 Lakeside avenue, gray iron, sugar mill castings and heavy general jobbing, two cupolas, 48 and 72-inch.

Lake City Malleable Iron Co., (formerly Chisholm & Moore) 5046 Lakeside avenue, miscellaneous malleable iron castings, three 20-ton air furnaces.

Nickel Plate Foundry Co., 14915 Woodworth road, gray iron, general jobbing, machine tool and diesel engine castings, one 48-inch cupola.

West Steel Casting Co., 805 East 70th street, steel, truck wheels, tractor castings, miscellaneous small and medium weight castings, one electric furnace, two converters.

Westinghouse Electric & Manufacturing Co., 1218 West 58th street, gray iron, brass and aluminum castings for electrical machines and equipment, headquarters for the lighting division of the company.

Moves District Office

The Chain Belt Co., Milwaukee, has moved its New York office from 50 Church street, into new and larger quarters in the new Chrysler building, 405 Lexington avenue, New York city. The new office will provide a third more space. W. H. Quinn is the New York district manager of the Chain Belt Co.

Magnetic Mfg. Co., Milwaukee, now has a new research laboratory under construction which will be devoted to the solution of special problems of magnetic separation. The laboratory is under the personal supervision of R. H. Stearns, founder and president of the company.

Malleable Foundry Makes Wagon Skeins

By Norman F. Hindle

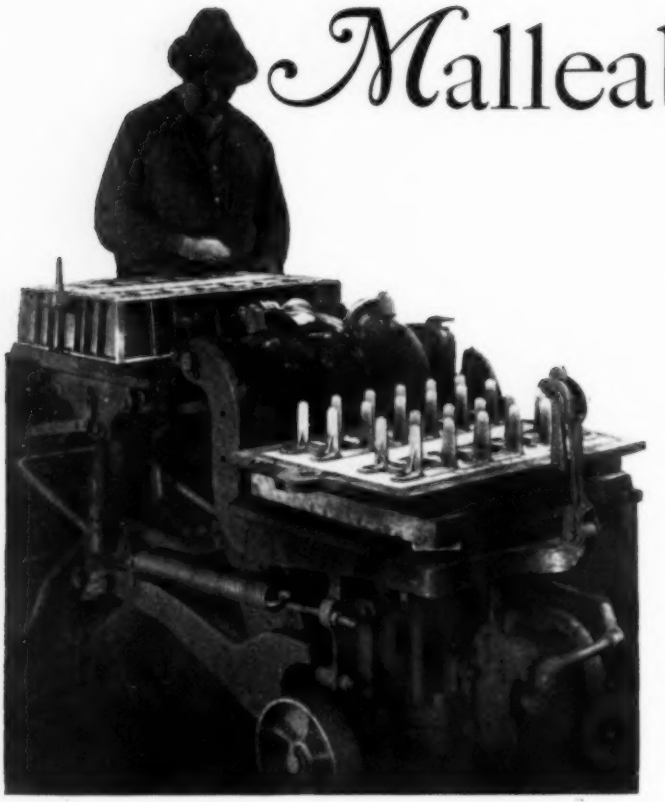


Fig. 1—Pole and Line Hardware Is Made on Molding Machines

ST. LOUIS, the largest city in the state of Missouri and the sixth largest in the United States, is the center of many industrial enterprises. Numerous industries contribute to the hum of production and not least among them is the foundry industry. St. Louis is one of the foundry centers of the country with 65 firms operating within its confines.

Has Jobbing Foundry

The St. Louis Malleable Casting Co. is one of two companies making malleable castings in the city. While that firm may be classed as a jobbing shop, it has developed a specialty of pole and line hardware which threatens to place it in that class of foundries devoted to the production of special castings.

The plant is located in the northern section of the city within a short distance of the Mississippi river. It consists of the offices of the company, a machine shop, casting storage, stock room, cleaning and annealing departments, pattern storage, coreroom, galvanizing department, pattern shop, laboratory and foundry. All departments with the exception of the laboratory and the pattern shop are located in the main building.

The main plant building runs east and west and faces the west. The company's offices occupy the northwest section of the building. Adjacent to these and on the south is a shop where the necessary machining operations are performed. A small stock room is located at the rear of the offices and behind this room is the casting storage department. The annealing and cleaning departments are located at the rear of the casting storage and occupy the major part of the older section of the building. Several small rooms to the right of the annealing department house units of the cleaning department.

The molding and melting departments, the core room and pattern storage occupy the remainder of the plant. The core room is located in the southwest corner of the building. The pattern storage and the core sand storage are in the rear of the core room. Gray iron and semisteel castings are manufactured in a small bay located along the west wall of the building between the machine shop and the core room. Two cupolas that supply metal for these castings are situated at the rear of the floors and in such a position as to be centrally located.

Use Two Cupolas

The cupolas were supplied by the Whiting Corp., Harvey, Ill. One is lined to 32 inches and the other to 45 inches. Two thousand pound charges are used in the 45-inch cupola while 1500 pound charges are used in the 32-inch melting unit. If a semisteel mixture is melted the charges consist of the following materials: Steel scrap, 25 per cent; iron scrap, 25 per cent and pig iron, 50 per cent. This gives an iron with approximately the following analysis: Total carbon, 3.00 per cent; manganese, 0.65 per cent; silicon, 2.25 per cent; phosphorus, under 0.30 per cent and sulphur, 0.08 per cent. A 50-50 mixture of pig iron and scrap is used to produce gray iron with the following analysis: Total carbon, 3.25; manganese, 0.50 per cent; silicon, 2.40 per cent; phosphorus, under 0.5 per cent; and sulphur, 0.08 per cent. Both northern and southern pig iron are used in this shop. Coke used in the cupolas is of the by-product variety. It has approximately the following analysis: Ash, 8 per cent; volatile constituents, under 1.00 per cent; fixed carbon, 91 per cent and sulphur, 0.7 per cent. Approximately 800 pounds of coke are used in the bed charge which is made up to 25 inches over the tuyeres.

Utilizes Molding Machines

The bulk of molds are made from matchplates on machines, thus reducing the hand molding to a small amount. Machines used in this foundry were supplied by the International Molding Machine Co., Chicago; Osborn Mfg. Co., Cleveland; Tabor Mfg. Co., Philadelphia; Milwaukee Foundry Equipment Co., Milwaukee and the Wm. H. Nicholls Co. Inc., Richmond Hill, Long Island, N. Y.

The main bay of the foundry extends from, and at right angles to, the gray iron floors and utilizes approximately two-thirds the length of the building. Molding floors are located at the middle of the gangway and along portions of the north and south sections. A 15-ton capacity, air furnace for melting malleable iron occupies about one-third the length of the building along the north wall. Molding floors are located beyond the furnace along this wall. A section at the rear of the gangway is used to dry the hand ladles used by the

molders in pouring off. Gas burners are employed in this drying process. A sand mixer built by the National Engineering Co., Chicago, is operated near the molding department, and is used to prepare sand for the foundry. The rear of the main bay and a portion of the south bay has been utilized for storage.

Two other bays are located north of the main bay. They are somewhat shorter than the main molding section. A portion of the bay nearest the main bay is utilized for machine molding while all hand molding is done in the farther bay. Two, 15-ton capacity, air furnaces are located between the bays in such a manner that approximately half of each furnace is in each bay. The remainder of the space in the near section is used as storage space and a similar portion of the far bay houses the shipping facilities of the plant. Some assembled castings also are stored in that department.

Uses Two Type Ovens

The coreroom, located at the southwest corner of the building, contains six rack type core ovens and two tray type ovens. Oil sand cores for the electrical castings produced by the company are made from a mixture of 80 parts silica sand and 1 part core oil. Miscellaneous cores are made of a mix consisting of 80 parts silica sand and 20 parts loam. They are dried at temperatures between 300 and 450 degrees Fahr. for from 1 to 4 hours depending on the size. All sand for the coreroom is prepared in a mixer supplied by the National Engineering Co., Chicago, which is located in an adjacent room with the core sand storage. A view of the coreroom is shown in Fig. 6.

A 2-story pattern storage is situated at the rear of the coreroom at its northeast end. A view showing the arrangement of the patterns is shown in Fig. 7. All patterns when not being used and not being repaired are stored in this section of the shop. Sections in each rack and each shelf are numbered. A card index is kept showing the location of the various patterns. While several patterns may be on each shelf it is an easy matter to locate a pattern by its number. The patterns also are segregated according to the class of work.

Molders in this foundry make the molds, set the cores and pour the iron. A gang of laborers shakes out and collects the castings and conditions the sand piles. Eastern sand from the Zanesville and Albany districts is used. New sand is added to the piles at intervals to keep them in the proper condition. As has been stated, matchplate and machine work is in use wherever possible. Skim cores are used in the majority of molds. As a result of the extreme care exercised in the method of gating employed, the foundry loss has been reduced to a considerable extent.

The company makes all classes of castings from those used in the most modern equipment, such as its specialty pole and line hardware, to those of almost forgotten days. A considerable tonnage of wagon skeins at one time was made. The firm still makes these castings and have developed a novel method of production. The skeen castings are molded by hand and four are cast in one flask. The rigging used is shown in Fig. 3.

Loose patterns are used in molding these castings. When the molder begins the operation, these are placed in the rigging as shown in Fig. 3. The rigging resembles a chair with the exception that the rockers are on the back. The seat is an aluminum plate containing four holes around which are mounted circular pieces of metal that fit against the shoulder of the pattern. A wooden piece is mounted in the rigging below the aluminum plate which also contains four holds but of smaller diameter than those in the plate. These act as guides for the patterns to keep them in perfect alignment in a perpendicular position.

Rams the Cheek

Skein castings are molded in a four part flask consisting of a shallow cope, a deep cheek, a shallow cheek and a deep drag. The shallow cheek is rammed first. Prior to the time that the molder places the cheek on the rigging, he places the

Fig. 3.—The Shallow Cheek Is Rammed First in Molding Wagon Skeins

patterns in their respective guide holes and puts a chill between the shoulder of the pattern previously referred to and the metal section mounted on the plate. After he has squared the patterns in the same line with each other by the use of a straight edge, he shakes a parting compound on the plate and places the shallow cheek on the plate. He then places rods in the hollow portion of the patterns and rams the cores around them. These rods increase the rigidity of the core. After the hollow sections that contain the cores have been rammed half full, vent wires, shown in position in Fig. 3, are placed in position in the core.

Fig. 2—Annealing Is Done in Sixteen, 20-ton Furnaces, Fired With Coal from Strip Mines

The cores then are rammed to the shoulder of the pattern and the molder fills the cheek with sand. Sand used in molding these castings is extremely open. After the sand has been rammed firmly in the cheek, the molder makes a parting along the center line of the shoulder. He then throws on some parting compound and rams some sand at the center of the mold and partly in the shank of the pattern. Here a further core reinforcement is rammed in place. It consists of two iron rings made of ¼-inch cross section iron connected by a bar of the same cross sectional dimensions. It resembles a pair of glasses with a straight instead of a bent nose piece. Each ring is placed over a vent wire and rammed in place in such a manner that each iron ring is in a separate core. Two of these pieces are used. When these reinforcements are in place, the molder brushes off the sides of the flask and placed the drag section on the cheek.

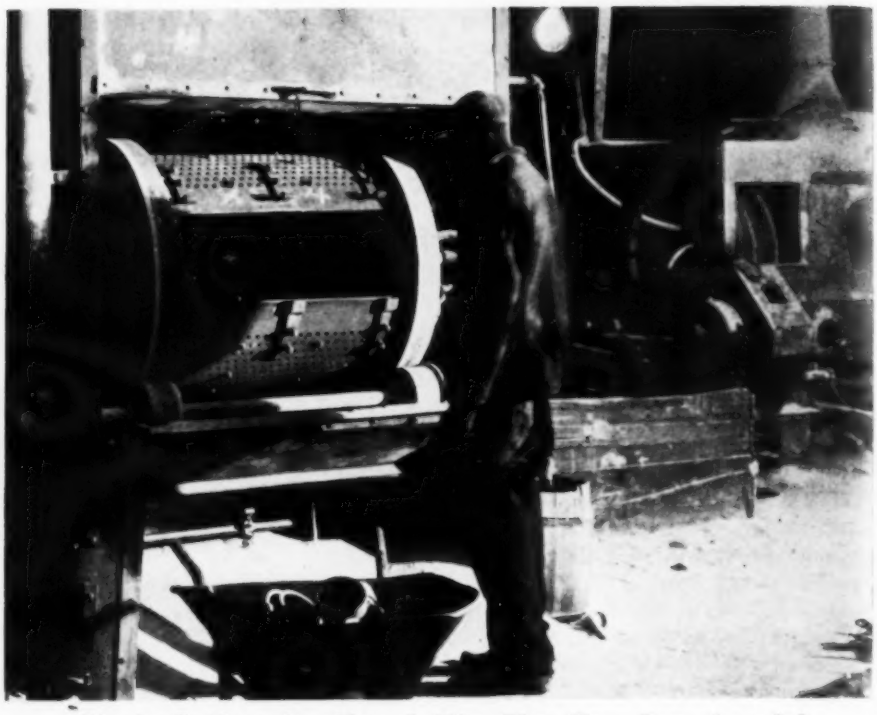


Fig. 5—Castings Are Cleaned After They Have Been Annealed

Describes Drag Flask

The drag, shown at the left in Fig. 4, is made in three sections, the central part which contains the largest body of sand and two side sections which swing on hinges mounted on a point on the flask even with the lowermost point of the pattern. These side sections form cheeks and have reinforcements for the sand at the sides and ends. Prior to the time the drag is placed on the cheek, the sides and middle sections are clamped together. It then is placed on the cheek, filled with sand and rammed. Sand is rammed firmly around the sides and lightly over the cores. It then is struck off, the vent wires removed and the bottom board nailed on the flask. The drag and cheek, which are clamped together, are rolled through 180 degrees on the rockers of the apparatus shown in Fig. 2. This then is lifted from the mold.

The molder sprinkles white parting sand over the face of the small cheek and places the large cheek, shown at the left in Fig. 4, on the small cheek. He places chills at the top of the pattern, places the gate stick and rams the mold. After the large cheek has been rammed properly, it is struck off and the molder rams some additional sand around the core rods that project from the top of the casting to add strength to the top of the green sand core. The parting of this cheek and the cope is exactly at the top of the core print on the pattern.

After the parting has been made, the molder places the cope on the cheek and fills it with sand. The sand in the cope is rammed firmly and the cope struck off. The mold then is complete. With the aid of another molder, the cope first is lifted off, the patterns rapped lightly and the large cheek lifted. The patterns again are loosened and the small cheek is lifted from the drag. The clamps on the drag now are removed and the molder pulls on the side of the flask and the side cheeks make a parting along the correct lines. The patterns are removed from the mold and any necessary patching is completed. The drag is closed and the clamps are adjusted. With the aid of the same molder, the small cheek first is placed in position, next the large cheek and last the cope. The core rods extend slightly from the top of the core and these push up into the cope and thus anchor the cores in position.

Fig. 4—Showing the Drag, Shallow and Deep Cheeks of a Wagon Skein Mold

Molds Pole Hardware

This method of molding has been in use at this foundry for the past 20 years and no method has been found to the present that improves upon it. This work was done on the hand molding floor in the far bay of the foundry. A further illustration of the class of work manufactured by the company may be seen in Fig. 1. This is one of the castings used in the construction of pole hardware. The particular machine shown

in the illustration is making the drag for this class of castings. In this instance four castings are made in a flask, two each from a gate. The cope was not rammed on a machine. Strainer cores are used in the mold. The men in charge of the foundry are of the opinion that this type gate assists in the production of sound castings.

Metal is melted in three, 15-ton, air furnaces. Two are hand fired and the other is equipped to use powdered coal for fuel. The powdered fuel unit recently was installed and

Fig. 6—(Above) Two Types of Ovens Are Used in the Core Room

has not been in operation for a long enough period to support any statement as to performance. However, the firm expects satisfactory operation in the near future. The hand fired furnaces use high grade, eastern Kentucky coal for fuel. This coal has approximately the following analysis: Ash, 3 per cent; volatile matter, 36.50 per cent; total carbon, 60.50 per cent; sulphur, 0.5 per cent and B.t.u. value, 14,500 to 14,900 per pound. Approximately 2.5 tons of iron per ton of fuel are produced by the hand fired furnaces.

While these furnaces were built for a 15-ton capacity, 16 and as high as 18 tons of metal have been charged. A heat is produced in from 4 to 5 hours depending upon whether the furnace was started cold or hot and the amount of metal charged. Starting on a cold furnace, 3.5 tons of metal per hour are produced but when the charge is placed in a hot furnace, the production is increased to 4 tons per hour. Metal is tapped when it is of the correct composition and has attained a temperature of between 2900 and 3000 degrees Fahr.

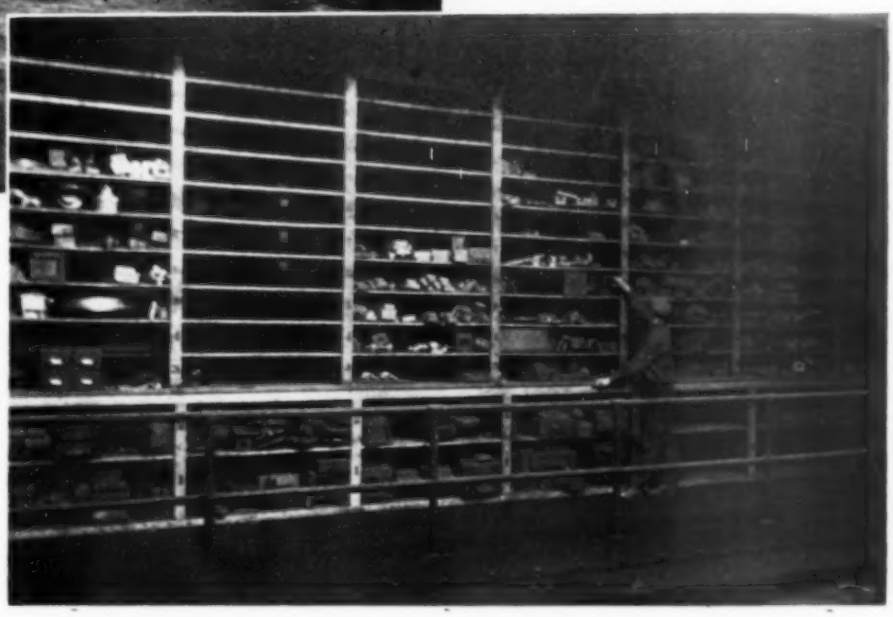
A new bottom is made in the furnace or furnaces in use every Sunday. Sand first is placed on the bottom and covered with a layer of briquettes of straw. Metal then is charged and the furnace is fired. The charge does not damage the bottom when it is placed in the furnace and the metal will not damage it as it melts if this method is used. Such a bottom is termed a *green bottom.*

Metal for the charge is placed in the furnace through the top. Charges used in the furnaces at the plant of the St. Louis Malleable Casting Co. consist of the following: Pig iron, 50 per cent; sprues and gates, 35 per cent and steel and annealed scrap, 15 per cent. This gives an iron with approximately the following analysis: Total carbon, 2.30 to 2.50 per cent; manganese, 0.25 to 0.30 per cent; silicon, 0.9 to 1.00 per cent; phosphorus, under 0.20 per cent and sulphur, under 0.07 per cent.

The method used to determine the temperature of the bath by observation may be a point of interest. A spoon of metal is taken from the furnace and its surface is observed. The time is noted when it is taken from the furnace and again when a film of oxide begins to form on the surface. The number of seconds which have elapsed is an indication of the temperature of the metal. Some melters fan the sample with their hat, the number of fannings before the film forms being an indication of the heat. This method of determining the temperature is based on the theory that when the metal is sufficiently hot, the heat waves given off keep the air from coming in contact with the molten liquid and for this reason the surface is not oxidized. Therefore, the longer the molten metal resists the air, the hotter the iron.

Tests are taken at intervals during the melting period to determine the condition of the bath. Molten metal is poured into small sand molds that give a round test piece. The piece is allowed to solidify in the mold and then is quenched in water. When it has cooled, it is broken and the fracture observed. The condition of the bath is judged from the fracture.

Fig. 7—(Below) A Record Is Kept of All Patterns Placed in the Pattern Storage



When the metal has reached the proper temperature and condition as indicated by the furnace tests, the furnace is tapped. Molds for the castings are segregated as much as possible, the light work being placed near the furnace. Metal for the molds near the furnace is tapped directly into the small hand ladles of the molders. Other metal is tapped into bull ladles suspended from a monorail or mounted on buggies which transport it to the various floors. Each molder pours the molds on his floor. A gang of laborers shakes out the molds and separates the castings.

After the castings have been transported to the cleaning rooms and

tumbled in a battery of 20 tumbling barrels made by the W. W. Sly Mfg. Co., Cleveland, they are ground on grinding machines supplied by the Safety Emery Wheel Co., Springfield, O. When they have been cleaned completely they are inspected. Castings that have passed inspection are transported to the annealing room in wheelbarrows.

A view of the annealing furnaces is shown in Fig. 2. This equipment consists of furnaces capable of annealing from 16 to 20 tons of castings per heat. These furnaces are fired with mine run coal from strip mines. Three to six furnaces are used at the same time. The temperature is controlled by a system of indicating and recording pyrometers. It is possible to know the temperature of each furnace in operation at any time. After the castings have been cleaned thoroughly they are packed in annealing boxes made by the company. Sand and clay are used as packing materials. The pots are stacked five high and red clay is used as a seal between the pots. These stacks of pots are conveyed to the furnaces by an electric truck and placed in the proper position. After the furnace has been filled and the door sealed in place, the annealing operation commences.

The furnace is brought up to 1600 degrees Fahr. in 24 hours and held at that temperature for 65 hours. The furnace and its contents then is cooled at a rate of 10 degrees Fahr. per hour to a temperature of 1100 degrees Fahr. The doors of the furnace are pulled and as soon as the contents of the furnace are cool enough the stacks of pots are removed. The progress of the heat treatment is checked at intervals by removing test specimens from the furnace.

After the castings have been annealed, they are again cleaned in a battery of 19 tumbling barrels manufactured by the W. W. Sly Mfg. Co., Cleveland, or are sandblasted and tumbled in machines that performs these operations simultaneously. These machines are supplied by the W. W. Sly Mfg. Co., Cleveland, and by the L. O. Koven & Brother Inc., Jersey City, N. J.

When the castings have been cleaned, they are ready for shipment or galvanizing. However, if the castings are subjected to the galvanizing operation when in this condition they are prone to develop a silvery structure that is brittle. For many years this condition was a source of concern to the manufacturers of malleable iron castings. In 1921, L. H. Marshall, metallurgist, Ohio Brass Co., Mansfield, O., in collaboration with the bureau of standards, discovered that heating the castings to 1200 degrees Fahr. and quenching them not only eliminated the brittleness but increased the resistance to impact. In this plant castings are subjected to that treatment before they are galvanized. The laboratory is located in a two-story brick building outside the main plant. Here the analyses, metallographic and other allied work is done. A second building at the rear of the laboratory and outside the main plant building houses the pattern shop. The company makes all its patterns and does some outside work.

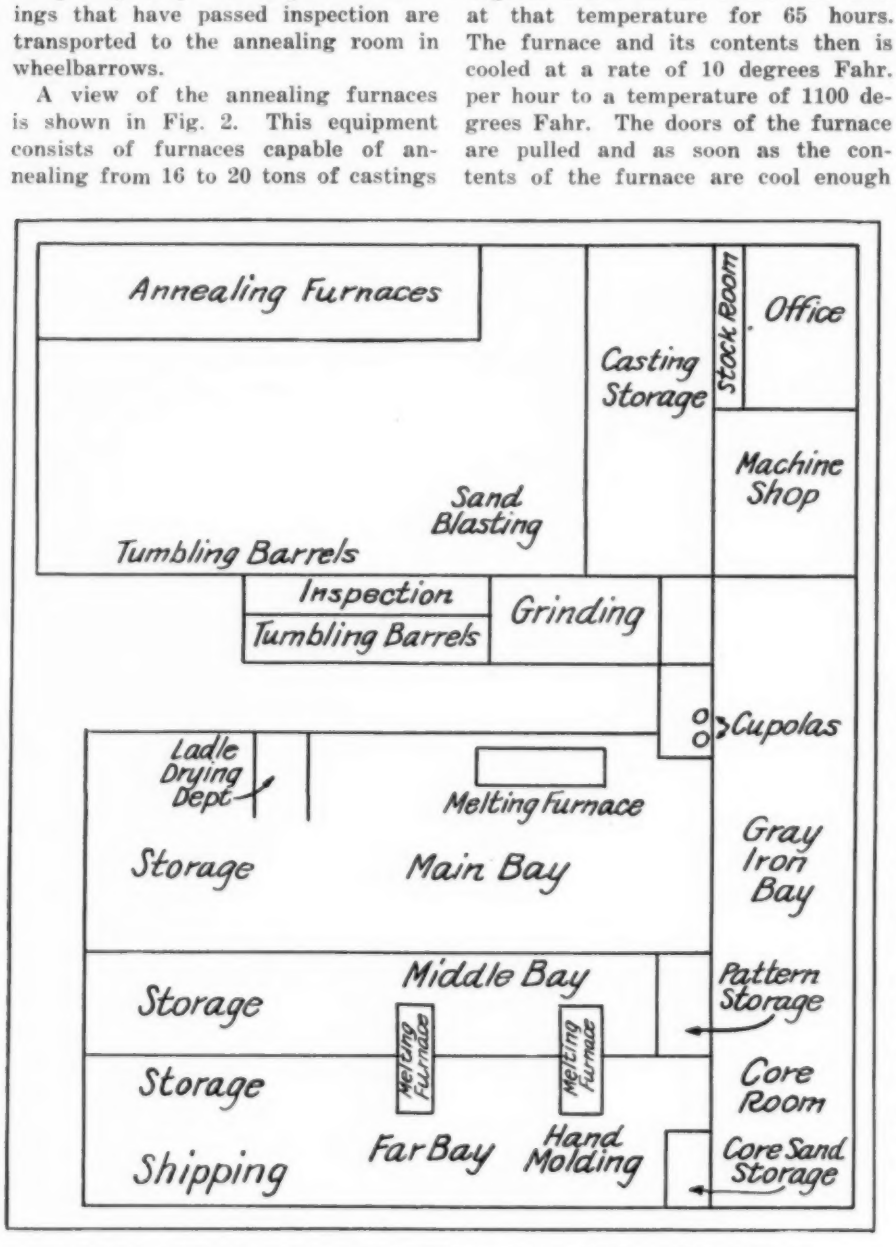


Fig. 8—Layout Showing the Location of the Various Departments

Wisconsin Founders Here Talk on Sand

The regular monthly meeting of the Wisconsin Gray Iron Foundry group was held April 2 at the Schroeder hotel, Milwaukee. B. Knight, Illinois Clay Products Co., Chicago, addressed the meeting on "Experiments in the Development of the Use of Synthetic Sand." In his talk, Mr. Knight, gave an outline of the methods used in the mining and preparation of fire clays. He spoke of various mixtures used for lining ladles in gray iron foundries and gave what he thought was the best mix to use. He was of the opinion that while chemical analyses and physical tests were of value in determining the properties of clays, their selection should be based on actual operative tests. He then outlined the development of sand testing in the foundry and gave some interesting data on synthetic sands. He quoted figures on rebonding of sand and told of the factors that brought synthetic sands into the foundry. The latter part of his talk was devoted to descriptions of gray iron molding jobs and the sand mixtures that should be used in making them.

R. J. Allen, for the past 12 years metallurgical engineer, Rolls-Royce Co. of America, Springfield, Mass., has accepted a position as research engineer with the Worthington Pump & Machinery Corp., Harrison, N. J. Mr. Allen was graduated from the University of Toronto, Toronto, Can., in 1913 and spent several years in both electrical and metallurgical work.

Industry Awaits Opening

(*Concluded from Page* 180)

can Foundrymen's association research associate, bureau of standards, Washington.

"Care and Maintenance of Fuel-fired Furnace Linings, and Selection and Use of Refractory Maintenance Cement in the Nonferrous Foundry," by H. E. White, Lava Crucible Co. of Pittsburgh, Pittsburgh; "Stronger Aluminum Castings by Improved Foundry Practice," by E. M. Gingerich and H. J. Rowe, Aluminum Co. of America, Pittsburgh, and "Progress in the Die-casting Industry," by Marc Stern, A. C. Spark Plug Co., Flint, Mich., are the papers to be presented at the session on nonferrous founding which will be held at 10 a. m. Two sessions to be held at 2 p. m. are on sand control and management. The sand control session will include reports of committees and a paper on, "Sand Control as Viewed from the Producers' Standpoint," by W. W. Kerlin, Enterprise Sand Co., Pittsburgh. Papers to be presented at the management session are "The Value of Sales Analysis and Market Research," by J. P. Newman, McGraw-Hill Publishing Co., New York, and "The Value of Cleanliness and Neatness in a Foundry," by Edward Trapken, Sandusky, O.

At 4 p. m. Wednesday, three shop operation courses will be in session simultaneously. The course on steel will relate to core room practice under the leadership of J. M. Sampson, General Electric Co., Schenectady, N. Y.; H. E. Mooney, Falk Corp., Milwaukee, and W. F. Wilson, American Steel Foundries, East Chicago, Ind. The gray iron course will cover gating and risering with H. W. Dietert, U. S. Radiator Corp., Detroit; E. M. Handley, Chain Belt Co., Milwaukee, and Dr. Fritz Meyer, National Radiator Co., Johnstown, Pa., as leaders. Induction-type electric furnace melting will be the topic of the course on nonferrous practice under the direction of R. W. Parsons, Ohio Brass Co., Mansfield, O.

In addition to the regular sessions on Thursday, May 15, two roundtable luncheon meetings on steel founding and nonferrous founding are scheduled for 12:15 p. m. At 10 a. m. a session on steel founding will include papers on, "Reclaiming Steel Foundry Sands," by M. D. Pugh, Illinois Testing Laboratories Inc., Chicago; "Australian Steel Foundry Practice," by D. Clark, Adelaide, Australia; an address by George Batty, Steel Castings Development bureau, Philadelphia, and the reports of committees. Simultaneously with that session an apprentice training session will be held with papers by E. H. Ballard, General Electric Co., West Lynn, Mass., on "Foundry Apprentice to Foundry Foreman," and on "Where Are the Young Foundrymen?" by S. W. Utley, Detroit Steel Casting Co., Detroit.

The roundtable luncheon session on steel founding will be directed by W. J. Corbett, Fort Pitt Steel Casting Co., McKeesport, Pa., while that on nonferrous founding will be in charge of H. M. St. John, Detroit Lubricator Co., Detroit. A 2 p. m. a session on gray iron metallurgy will include the following papers: "Carbon and Sulphur in the Cupola—Some Properties of Coke," by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., and "Correlation of Tests for Cast Iron," by J. G. Pearce, British Cast Iron Research association, Birmingham, England. Mr. Pearce is presenting the annual exchange paper of the Institute of British Foundrymen.

Shop operation courses to be held at 4 p. m. include steel, gray iron and nonferrous founding. The course on steel founding will discuss practical aspects of heat treating under the leadership of A. W. Lorenz, Bucyrus-Erie Co., South Milwaukee, Wis.; H. P. Evans, Hubbard Steel Foundry Co., East Chicago, Ind.; D. Zuege, Sivyer Steel Casting Co., Milwaukee, and A. C. Jones, Lebanon Steel Foundry, Lebanon, Pa. The gray iron course will deal with high test irons, alloy additions, and heat treatment and will be under the direction of H. Bornstein, Deere & Co., Moline, Ill., and F. B. Coyle, International Nickel Co., New York. Indirect-arc-type electric furnace operation will be the subject of the nonferrous founding course under the leadership of D. Broggi, Neptune Meter Co., Long Island City, N. Y.

Only two sessions are scheduled for Friday, May 16, the closing day of the convention. These are on materials handling, and on melting furnaces and core practice and will be held at 10 a. m. The session on materials handling will include "Continuous Core Ovens," by D. B. Hill, Palmer-Bee Co., Detroit; "Materials Handling," by W. M. Booth, Syracuse, N. Y., and "Reducing Materials Handling Cost in the Jobbing Foundry," by F. C. Campbell, Eastern Corp., New York. Three papers will be presented at the session on melting furnaces and core practice. These are: "Induction Furnaces for Ferrous and Nonferrous Metals," by Manuel Tama, Berlin, Germany; "Value of Analyses and Specifications for Core Oil," by J. A. Gitzen, Lindsay-McMillan Co., Milwaukee, and "A Study of Nonferrous Crucible Melting," by H. E. White, Lava Crucible Co. of Pittsburgh, Pittsburgh.

In addition to the various shop operation courses on gray iron which have been mentioned, evening discussion groups will be held on Monday, Tuesday, Wednesday and Thursday evenings. These will cover the fundamentals of cupola operation and will be under the direction of C. J. Scullin who will be assisted by a number of metallurgists. The meetings will convene at 8 p. m. in the Hotel Statler.

One of the regular and well-attended features of the annual convention is the annual foundry instructors dinner which will be held this year on Wednesday evening, May 14. This feature was organized for the purpose of bringing together the engineering shop instructors of the various engineering schools at a time when they also might take advantage of the convention sessions and exhibition. The dinner meeting will be addressed by a well-known foundryman on the place of the engineering graduate in the foundry industry. A. E. Wells, director, engineering shop laboratories, Cornell university, Ithaca, N. Y., will preside.

Gray Iron Institute to Add Research Man

The comprehensive technical program of the Gray Iron institute received further impetus at the institute board of director's meeting held in Cleveland, April 9, when the board authorized the employing of a full-time research engineer to direct the technical activities of the institute. With the expansion of the membership of the institute the need for an expert full-time technical director or research engineer has been apparent. No selection has been made yet from the available candidates for the position. The annual meeting of the institute will be held in Cleveland Wednesday, Oct. 15.

Twin City Group Meets

The regular monthly meeting of the Twin City Foundrymen's association was held at the Campus club, University of Minnesota, Minneapolis. Following dinner the group was conducted on a tour of the department of mines and experimental station of the university.

Connersville Blower Co., Inc., connersville, Ind., has awarded the contract for the construction of a 25 x 125 foot addition to increase its production facilities.

Fundamentals of
FOUNDRY PRACTICE

Directions Are Given For Applying Wet Blacking According To Any One of Several Methods—Flask Guides Are Described and Illustrated

By Ivan Lamoureux

Interpreted in the Light of American Practice by Pat Dwyer

Part IX

WHEN the core is made without a pattern, and the prints are in the horizontal plane and the joint cuts them in half, the edge of drag is flattened a little by the sharp edge of the slick. This will prevent the edge from breaking. The space under the print usually is filled with a piece of iron or a brick. The sides of the prints are shaved to provide clearance for the core. The cope print also is shaved so that the cope may be tried off and on without causing any sand to drop off. The space between the core and the print finally is closed by some clay or dough rolled between the fingers or on a board and lengthened out to form a worm. The bottom of the drag print should not be shaved, and thus destroy the exact base for locating the core. The thickness of the casting would not be uniform.

Black Wash the Mold

When a core with large prints is molded in a box, a light touch with the slick on the edges of the print is enough to prevent the edges from crumbling.

After the mold has been patched and the dust cleaned out, it is black washed. If the surface of the mold is a little dry and if any repairing has to be done, the mold should be sprinkled lightly with some fresh water, to give the sand some bond.

Fresh water should be used as it penetrates instantly into the pores of the sand. Salt water or clay water contains fine grains which clog the pores of the sand and accumulate in a more or less compact sludge on the surface of the walls.

Blacking which should be neither too thick nor too thin is applied to the surface of the mold with a brush or a swab. In many modern foundries the blacking is applied with a spray gun operating on compressed air.

To spread the black wash properly it is necessary to employ brushes or swabs as large as possible. The black wash must be stirred frequently. This operation is accomplished more easily when using a hand brush. The black wash should be spread fairly thin on the joint. The swab is dipped alternately in the water and in the black wash.

The blacking first is applied along the edge of the joint, then spread over the vertical walls, and finished at the bottom. If the blacking is started at the bottom, the surface will be spoiled later with drops shaken off the brush and with blacking that trickles down the sides.

Uses Hemp Swab

The water in the black wash is absorbed quickly by the sand. The molder should not pass his brush twice over the same place. If he does he runs the risk of removing the softened sand.

A hemp swab shown in Fig. 89 is used to blacken deep ribs, rims of pulleys, flanges of pipes. The work

Types of Flask Pins

TECHNIQUE required for applying wet blacking to the face of a mold, can be acquired only through practice. A little knowledge in advance will prevent the beginner from falling into many of the usual errors which characterize the actions of the apprentice or molder who is not familiar with the practice of finishing molds in this manner. Accurately fitting guide pins constitute one of the most essential factors among the many involved in the production of castings. Local conditions in many instances determine the best type to adopt. On occasional jobs, a laxity in the pins is compensated for by the vigilance of the molder who crowds the cope in one direction, but in repetition work, mass production or under other conditions where the flasks are matched indiscriminately, the pins and pin holes are machined and fitted with the greatest accuracy. In many instances the holes are bushed and the bushings are renewed when they show the least sign of wear.

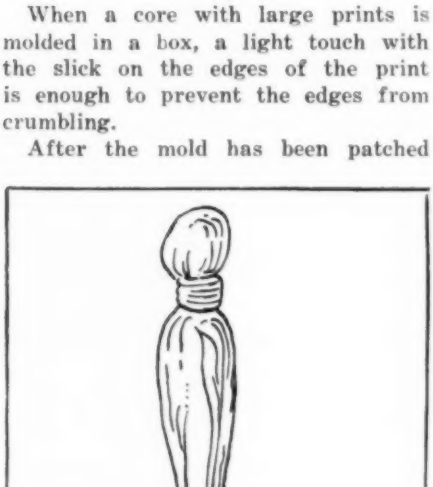


FIG. 89—A TYPICAL HEMP SWAB

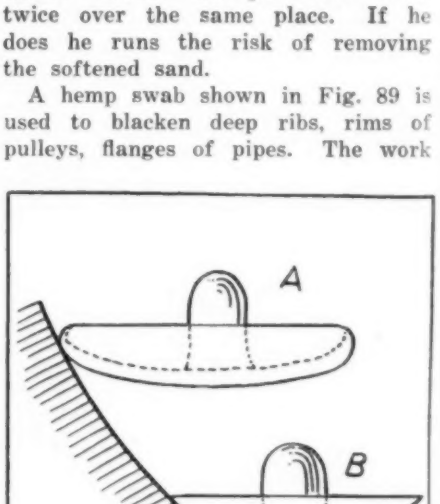


FIG. 90—TOOL *B* IS PREFERABLE TO TOOL *A* FOR SLICKING BLACKING

may be done rapidly without risking the possibility of any sand falling off.

A considerable amount of care and skill is required to slick the blacking with the tools. Only the edge of the slick should touch the mold. As a general rule the harder the sand has been rammed and the fatter the sand, the easier it is to slick the black wash.

Slicking can be accomplished more readily by sprinkling a little graphite or charcoal on the surface and by greasing the tool with a little oil. However, the oil should be applied with considerable discretion. An excess of oil prevents the mold from drying readily, especially in the deep sections. If the tool has left any traces on the mold they can be removed by painting the face with a camels hair brush dipped in a thin solution of blacking and molasses water.

In many instances the blackwash on cylindrical pieces and pieces with curved or irregular surfaces is not slicked, provided of course, that the blacking has been spread with care and is not too thick.

Describes Mushroom Slick

If it is necessary to slick the blacking, the mushroom slick, Fig. 90, should be used. The lower tool *B* is the more suitable of the two. The blacking will lift and *follow* the tool *A*.

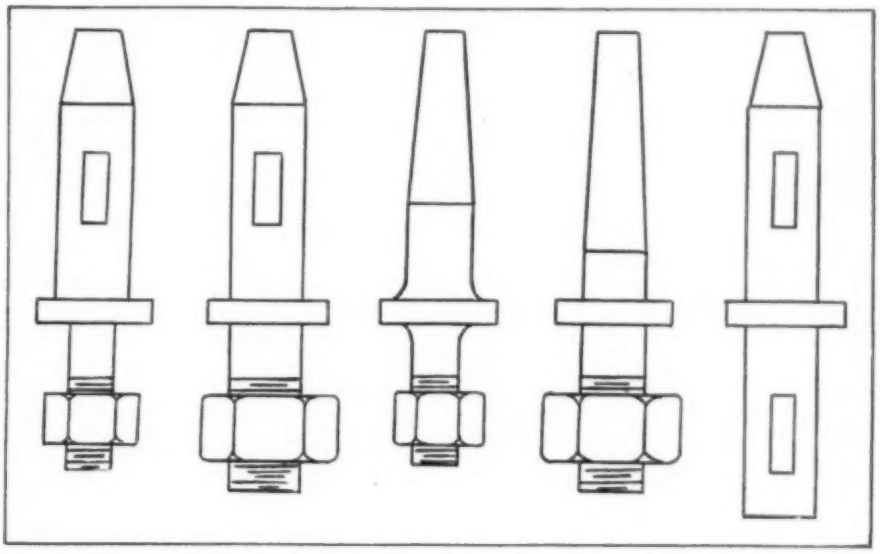
Castings made in loam, generally strip cleaner than pieces cast in sand. This results from two causes. The dry loam mold absorbs water readily and thus can support a thicker layer of blacking. The loam is more resistant and does not mix at all with the blacking. The layer of blacking is thinner on sand molds because the moist mold absorbs less water. It is less resistant and the sand mixes somewhat with the blacking. A sand core previously dried and then blacked will come out of the casting as easily as a loam core.

In some cases and especially in the molding of gears, the cope is tried on the drag after the pattern has been removed and before the mold is dried. This prevents the formation of fins and also prevents the sand from crushing when replacing a dry sand cope.

The joint surface is sprinkled with white sand, before the cope is returned to prevent the cope and drag from sticking. The white sand should not be spread over the bottom of the mold, where otherwise, difficulties would be encountered in removing it after the mold had dried. The cope is lowered on to the drag and care is taken to make sure that the cope has come down all the way. The cope then is removed again and the two parts of the mold are placed in the oven if everything is all right and the teeth show a good touch.

After the mold has been dried, the cores are set in place and the cope is replaced. For this, it is necessary to wet a strip of sand included between the vents and the edge of the mold with the brush. A small ridge is cut with the trowel to form a joint in the soft sand when the cope is replaced.

The cope is rolled over and placed over its guides or dowels, and then lowered all the way down. The mold is taken apart once more for final examination, and if found satisfactory it is closed and poured.



FIGS. 91 TO 95—VARIOUS TYPES OF FLASK PINS. THE PIN IN THE CENTER IS ROUGH FORGED WITH FILLETS ON BOTH SIDES OF THE COLLAR AND IS NOT RECOMMENDED

Occasionally minor repairs are required. If the ridge of sand is not pressed down uniformly, a small quantity of fresh sand should be spread over the low areas. The cope may have crushed the joint edge of the drag, or projecting bodies of sand may have fallen from the cope.

When the crushing is slight, the fallen sand is lifted out of the drag and the broken area is anointed lightly with oil. If the dry mold has been crushed to any considerable extent, it should be patched. The broken off sand is removed. The part to be patched is daubed with wet molding sand or loam applied with the fingers. Nails are inserted as previously explained. The required amount of sand is pressed on with the fingers. It is finished with the tools to the proper shape, blackwashed and then dried with a large piece of iron heated to a red heat, with a small coke or charcoal fire-pot or with a gas or oil torch.

Loam is particularly adaptable where the sand has fallen off in flakes from a cope. It provides an excellent adhering surface to retain the added sand. A good loam that sticks is preferable to a clay wash which wets the sand without making it adhere properly. To prevent variations in closing the molds, the molder should see to it that the two parts of the flask match as closely as possible. Unfortunately this precaution is neglected too often by many molders.

Under the name dowels, pins or guides, metal rods serve to align the various parts of the flask in an assembled mold. They should be checked frequently and examined with care. It is not at all rare to find any number of flasks in a foundry with dowels, corroded or eaten by rust and with a corresponding play in the lugs. Risk of turning out defective castings always is present.

To remedy this inconvenience, the molders have adopted the habit of lowering the copes *by the sun*, that is, the moment the pin enters the opening in the lug the flask is crowded to the left and toward one of the ends. One molder says to the other, "Hard to me and sun about." Among the various types of dowels, should be mentioned the machined dowels shown in Figs. 91, 92, 94 and 95 and the rough-stamped or forged dowels illustrated in Fig. 93.

The threaded portion of the dowel pin shown in Fig. 91 is smaller in diameter than the part which guides the flask part. This is a serious defect. The dowel pin is weak at the spot where it should have the greatest strength. Furthermore, as the dowel pin is turned to two different diameters, the flask lugs have to be drilled to two different diameters. One with a large diameter for the guide part and the other with a smaller diameter for the threaded portion. A

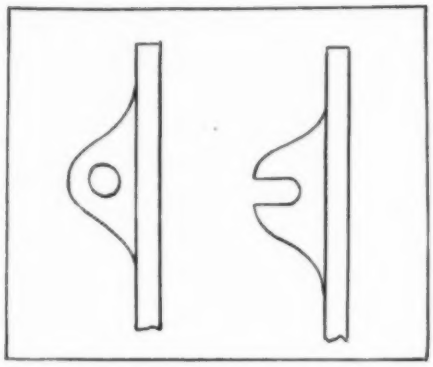


FIG. 96—ILLUSTRATING PIN HOLE AND SLOTTED LUGS

more rational style of pin is shown in Figs. 92, 94 and 95, with the threaded portion the same diameter as the remainder of the pin.

The dowel pin shown in Fig. 94 is recommended especially for machine molding. It shows a short cylindrical part above the collar, which fits closely in, enters the lug or ear on the side of the flask. The remainder of the pin is tapered, to facilitate the removal and the replacement of the cope. Where pieces are molded with high projecting parts, the dowel pins are made long enough to insure perfect guiding.

The dowel pin with the two slots, Fig. 95, has one great advantage. It may be attached or removed easily. Thus if it becomes necessary to store the flasks, the pins can be removed, greased and stored in a safe place. Also an infinite number of flasks can be clamped with a small number of these dowels.

However the holes in the lugs must be drilled to an exact diameter and a flat spot should be machined on the lugs to hold the pin in an upright position when the key is driven.

Forged Dowel Pins

Rough-stamped or forged dowel pins shown in Fig. 93 are not recommended. Their cross-section is not uniform. The shoulder naturally has quite a fillet which causes some play in the lugs of the flask. Under such conditions it is readily apparent that to secure all the accuracy some molds require is extremely difficult.

In practice, rough dowel pins are used in molding castings of abnormally large size, castings of large diameter or great length. The machined dowels are reserved for molding ordinary and smaller castings ordered in large quantities.

The Molerat system of casting is used for obtaining foundry flasks which can be fitted together in the rough after leaving the sand. The flask is molded in open sand according to a cast iron templet. The size of the holes and the lugs depending on the size of the flask. The templet is set level on a bed of sand and a joint is made on a level with the lugs. A dowel pin is placed in the hole in each lug, which thus leaves a coreprint. The core forms a hole to be used either for the pin when molding a cope, or for the shoulder when molding the drag.

The templet is taken out and the pattern of the flask, a rough frame of wood, is set in place. The lugs are covered with cast-iron plates or cakes of loam.

Flasks obtained by this process are good and their cost is not high. The great disadvantage lies in not being able to straighten a crooked pin or remove it except by drilling a new hole in the lug, to permit inserting another pin.

To separate the two parts of a mold and take out the casting, the crane sometimes is hooked on to the cope and the drag forced down by inserting a bar between the two parts. If the drag remains hanging by one end or side the strain will bend the pins. In a case of that kind, straightening the dowel is impossible. It either will break off or break the lug.

This form of accident can be avoided by using slotted lugs instead of the drilled lug, shown in Fig. 96. The slotted lug will allow the drag to slide off obliquely in a case like that cited. Slotted lugs can be applied to all flasks, although they are less accurate in lining up the flasks. This objection is overcome by using a slotted lug at one end of the flask and a drilled lug at the other end.

The tapered dowel pin Fig. 97 is driven tightly into the socket of either the cope or drag. The taper allows enough play in the corresponding hole in the other part of the flask. These dowels are advantageous, due to the speed with which they can be made, placed and removed.

Loose Dowel Pins

In machine molding, the flasks frequently are guided by dowels attached to the machine, consequently when closing the mold it is necessary to adapt dowels to the flask that are readily removable as shown in Fig. 98. The style of guide pins used in machine molding can be applied with advantage to manual molding. The copes and drags are provided with double lugs or guides. The holes ¾-inch diameter are drilled through a templet. A templet is indispensable where exact matching is required.

The dowel pin with a diameter of ¾-inch is inserted in the socket of the cope and the molder lifts it with the flask. After the flask is assembled, he takes the pins out and uses them on another flask. This method is economical. With two pins he can mold and assemble as many flasks as desired. Obviously the length of the pins will have to correspond to the height of the flask used.

A series of hardened templets are

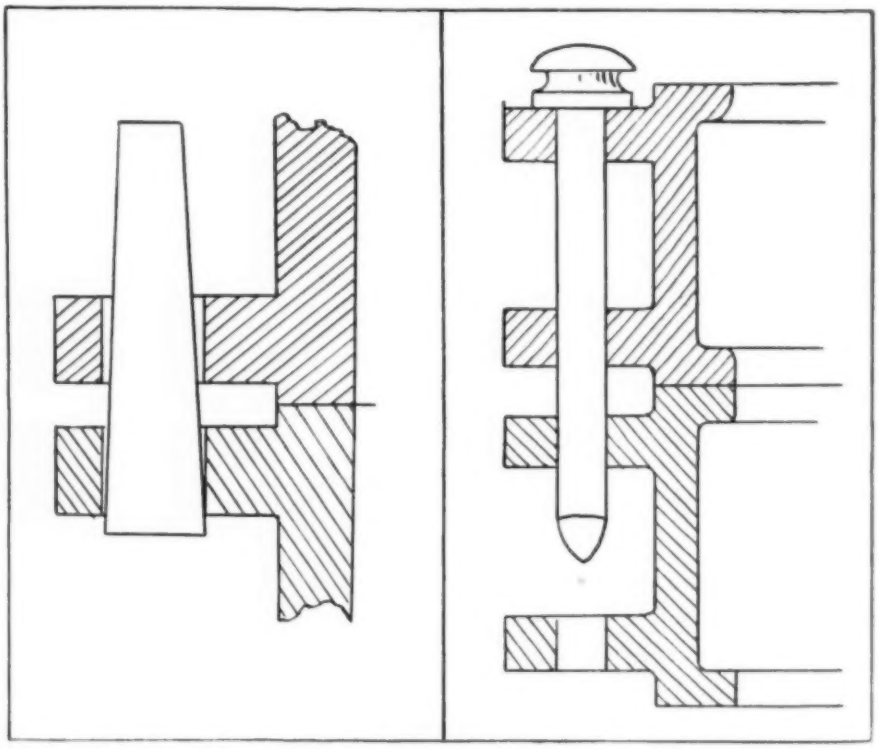


FIG. 97—(LEFT) TAPERED PIN IS FITTED TIGHTLY IN LOWER LUG. FIG. 98—(RIGHT)—LONG GUIDE PIN MAY BE REMOVED AFTER THE FLASK HAS BEEN ASSEMBLED

required for drilling holes in the guides or sockets. Thus one accumulates a series of interchangeable flasks and dowel pins, although in a few months the accuracy of the matching will be diminished on account of constant wear.

In the molding of many machine castings, absolutely exact dowelling is not essential, but some castings are no more than a fraction of an inch in thickness and no differences can be tolerated in the matching of the two flasks.

The following method, illustrated in Fig. 99, maintains perfect alignment of flasks at a low cost. The rough cast holes in the flasks are large enough to be lined with antimonous lead bushings. The antimony content makes the composition exceedingly hard and increases its life. The flask is placed on a flat slab having two or more dowels approximately one hundredth of an inch larger in diameter than that of the dowels which will be used on the flasks. The melted metal is poured in and after it has cooled the flasks will be matched perfectly with each other. In complicated molds cores where the metal is likely to run out when pouring, the adjustable dowels on flasks are a source of danger. If the melted iron lands on the bushings, repairs will have to be made before using them again.

To increase the life of the lead-antimony bushings, copper bushings with a wall thickness of about one-tenth of an inch, are placed inside the lead bushing as shown in Fig. 100. The flask is placed on the templet, the copper bushing inserted and then lead is poured in the space between the outside of the bushing and the wall of the rough cast hole in the lug. When the bushings become worn, the flask is placed over a fire, the old bushings are melted out and new ones put in again.

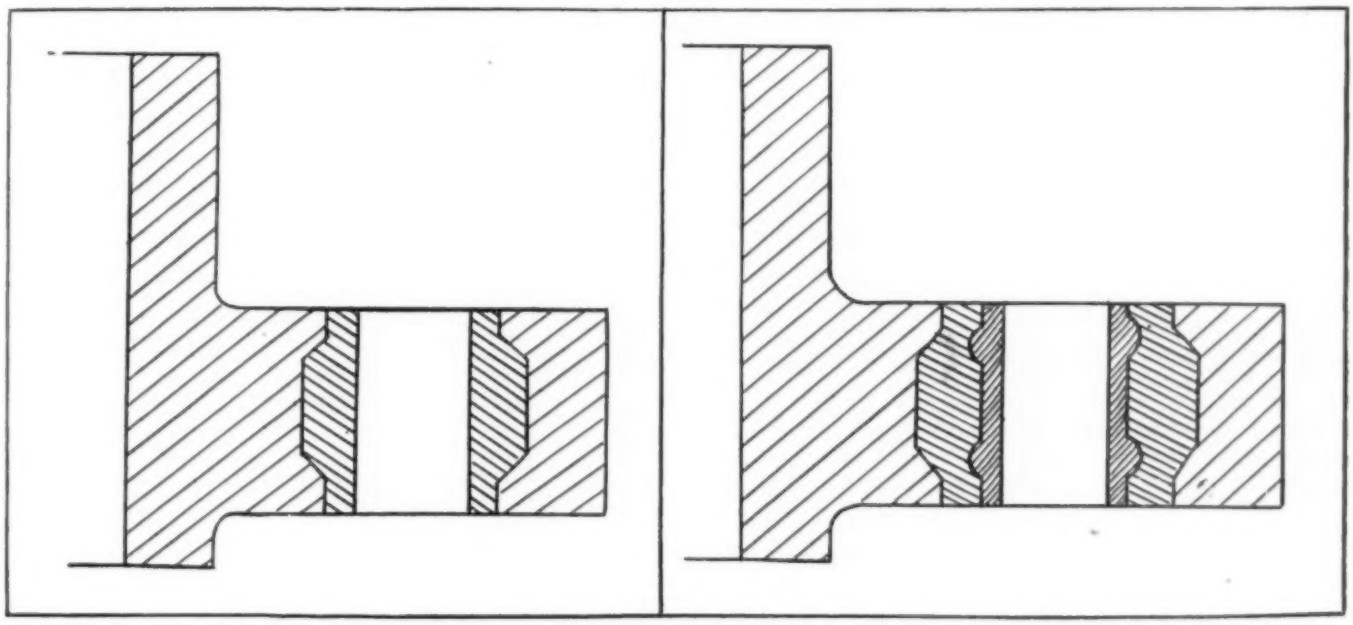


FIG. 99—(LEFT)—THE PIN HOLE IS BUSHED WITH A SOFT METAL MIXTURE. FIG. 100—(RIGHT)—A COPPER BUSHING IS SLIPPED OVER THE PIN AND THE SPACE AROUND IT IS FILLED WITH THE LEAD AND ANTIMONY MIXTURE

Equipment Group Adopts New Plan

The Foundry Equipment Manufacturers' association at its meeting in Cleveland, April 16, authorized and adopted a development plan of an unusual character. This organization which represents many of the largest firms engaged in the manufacture of machinery and equipment for foundry service finds its point of contact in a common customer rather than a common product. This controling factor, peculiar to only one or two other trade associations, made it desirable to group the industry into different classifications for efficient operation. These classifications are based upon the similarity of equipment manufactured by the different groups.

Special problems relating to each of these classifications and not common to the entire association, thus may be handled on a more practical basis. Standardization work, particularly as relates to commercial practices, statistics by groups which will afford a more accurate guide to business trends and the compilation of general figures from all of the group classifications will form one of the major activities of the association. The work of the credit bureau will be expanded. Those classifications which already hold representation in other trade associations and the products of whose members are used only in a limited way in the foundry will find no duplication of effort in the reorganized Foundry Equipment Manufacturers' association. It is the intention of the foundry equipment association to co-operate rather than duplicate the work of such groups as the crane manufacturers and others.

According to R. P. Dryer, who has been chosen as executive secretary, the Foundry Equipment Manufacturers' association hopes to establish a close co-operation with other organizations in the foundry and allied industries, particularly as applies to commercial practices. This can be accomplished more successfully if the entire foundry industry presents a united front.

During the forthcoming convention of the American Foundrymen's association in Cleveland, May 12 to 16, the Foundry Equipment Manufacturers' association will maintain a booth in the arcade connecting the main auditorium building with the west exhibition hall. The next regular meeting will be held at Cambridge Springs, Pa., June 19 and 20. In the meantime, different groups of the organization will work out detailed plans of operation.

John A. Morrissey, manufacturer's agent, has moved from 1487 Hertle avenue, Buffalo, to 1807 Elmwood avenue. Mr. Morrissey recently has become representative in the Buffalo territory for the Industrial Silica Corp., Youngstown, O.; Sterling Wheelbarrow Co., Milwaukee, and the American Radiator Co., New York.

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¶ Reciprocity of Coercion

RECIPROCITY implies an exchange of favors, or the trading of materials or concessions upon a fairly equal basis. It is familiar in small town business affairs, where the wife of the leading grocer buys her wardrobe from the merchant whose family trades with her husband's grocery. In larger affairs, the same principle has been applied, with many ramifications. A railway company will buy rails and fastenings from a steel mill that ships over that railroad's tracks. An electrical manufacturing firm buys a furnace or oven from a company which specifies only the transformers, motors and panel equipment of the electrical concern.

AS LONG as a true state of reciprocity exists and the basis remains one of an exchange of favors no one is injured. However, when an additional step is taken by the purchasing department of either party and pressure is brought to bear, that's another story. The term for such a state is coercion, not reciprocity. In other words, if the railroad says, in this purely imaginary case, that it will not buy the steel company's rails or sundries unless that steel company ships over this railway's own lines, reciprocity vanishes and coercion begins. Many purchasing departments and not a few sales managers would do well to study the definitions and shades of meaning which distinguish these two words.

¶ Clay in Sand

A GREAT deal of work has been done in the field of sand investigation, particularly in recent years since the American Foundrymen's association has interested itself in the movement. In fact the number of members of the association serving on various sand committees, is greatly in excess of the number engaged on any other of the association's many activities. Standards have been established on many features and a system gradually is coming into existence for reducing the myriad of intangible factors into something to which the foundrymen may apply simple tests, and secure accurate readings. Research notoriously is a slow process and is pursued along a tortuous road that constantly is branching off into bypaths. Some of the bypaths end abruptly, while others open into extensive, new and hitherto unsuspected fields.

AT ONE time sand investigators were confident that chemical analysis would disclose all sand secrets and would serve as a reliable foundation from which to draw conclusions and make determinations. Later, grain size and shape, also relative amount of bonding material, seemed to offer a yardstick by which the quality of sand might be measured. Practical tests in all cases showed that while the methods were satisfactory in some instances, they could not be applied universally. Two sands of approximately the same analysis might show a wide divergence in point of service. Sands showing similar screen characteristics, did not necessarily possess the same refractoriness, crushing strength, length of life or resistance to erosion from the flowing metal. Recent investigation has shown that the condition of the clay, or bonding agent exerts a more profound influence than the actual amount contained in the sand.

¶ Encourage Home Building

BANKS report large sums available for loans. Some of this condition is due to the liquidation of stocks, voluntary or forced, which took place last fall. Industrial and commercial building permits are running well along in line with the past several years. Residence construction is lagging. With large sums available for financing construction, an especial effort should be made to interest those employes whose means will permit them to build a home. Slightly lower prices on building materials, the availability of labor, the need for creating employment and interest of the prospective homeowner all tend to create of situation where building should be encouraged.

EMPLOYERS know that homeowners are more dependable employes. Their interest in acquiring property is an incentive to better work. Some organizations not only encourage, but actually offer financial aid to their men in building. The present situation, the evident slack in residence construction, undoubtedly will be followed by housing shortages in some localities. This can be avoided, business conditions can be improved and castings demand can be assisted by creating sentiment for residence construction this summer.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

R. P. DRYER, chosen executive secretary of the Foundry Equipment Manufacturers' association at a meeting held in Cleveland April 16, has had a varied experience in the foundry and the allied equipment industry. Mr. Dryer was born in Fort Wayne, Ind., Oct. 25, 1880. He received his early education in the public schools and attended Rose Polytechnic institute, Terre Haute, Ind., and the University of Michigan, Ann Arbor, Mich. After leaving college he was employed on engineering and sales work for the William Tod Co., Youngstown, O., now the United Engineering & Foundry Co. His next employment was with the Canada Foundry Co., Toronto, which afterwards was merged with the Canadian Allis-Chalmers Co. During the war Mr. Dryer returned to this country and was engaged in ordinance construction work. He then was employed by Scovell-Wellington Co., Boston, industrial engineers, to develop the trade association administrative department of that organization. He was engaged in this work for five years, leaving in 1923 to establish a sales office in Cleveland where he represented the Whiting Corp., Harvey, Ill., the Stanton-Thompson Co. and the National Engineering Co., Chicago. Since 1928 Mr. Dryer has engaged in independent practice as a trade association executive and is a founder member of the American Trade Association Executives. He also is a member of the Cleveland Engineering society, the Commercial Arbitration committee of the Cleveland chamber of commerce and the National Council of the United States chamber of commerce.

R. F. Cuyler, Lansing, Mich., has been named general manager of the Ray-Glo Corp., Athens, O., stove manufacturer.

S. Griffith has been elected general manager of E. C. Stearns & Co., Syracuse, N. Y., gray iron castings producers and hardware manufacturers, to succeed E. A. Hurdman.

Henry E. Hill has resigned as purchasing agent of North & Judd, New Britain, Conn., to become connected with Beardsley & Wolcott Co., Waterbury, Conn.

George U. Harris, New York, has been elected a director of Lima Locomotive Works Inc., Lima, O. He fills the vacancy caused in 1929 by the resignation of his father, John F. Harris.

William A. Ingram, secretary and treasurer, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., has resigned. Lewis N. Aller, assistant secretary and treasurer, has been elected to succeed Mr. Ingram.

Paul J. Nutting has been elected president of the Lee Foundry & Machine Co., Plymouth, Mich., to succeed H. S. Lee, resigned. John Cole is sales manager at the company's Detroit headquarters, 2970 West Grand boulevard.

R. P. DRYER

R. C. Bird, formerly connected with the Chain Belt Co., Milwaukee, and for the past two years with D. O. James Mfg. Co., Chicago, makers of transmissions, gears, motors, etc., has been appointed sales engineer for Chicago Steel Foundry Co., Chicago.

W. B. Kochenderfer, formerly in charge of engineering and sales for Lake Engineering Corp., Buffalo, recently was appointed chief engineer of the hydraulic machinery department, R. D. Wood & Co., Philadelphia and Florence, N. J., builders of medium and heavy hydraulic machinery.

Albert Roellecke, formerly of New York office of Otto Weolff & Co., and later vice president of Steel Union Co. Inc., New York, the American office of Vereinigte Stahlwerke, A. G., Dusseldorf, Germany, has resigned to become connected with Haleberger Huette, Brebach on the Saar, Germany, maker of cast iron pipe and fittings.

Frank A. Miller, Buckeye Steel Castings Co., and Frederick Mirick, F. O. Schoedinger Co., Columbus, O., have been appointed to serve as arbitrators in Columbus commercial disputes which are submitted under rules of American Arbitration association. Lucius R. Eastman is president of the association.

Sheldon Clark, Sinclair Consolidated Oil Corp., and A. H. Berger, vice president and secretary, Advance Rumley Co., La Porte, Ind., were elected directors of the latter company at the annual stockholders meeting, filling vacancies caused by the resignation of Lawrence J. Hirsch and the death of Maurice Fox.

James P. Allen, who retired last year as president and general manager of the Union Steel Casting Co., Pittsburgh, has been elected a director and sales department counsel of the Machined Steel Castings Co., Alliance, O. Mr. Allen is a director of the Blaw-Knox Co., Blawnox, Pa., and a director and member of the executive committee of the Pittsburgh Rolls Corp., Pittsburgh.

Mark A. Brown, formerly of Kokomo, Ind., but more recently of Chicago, has been elected chairman of the board of the Globe American Co., the name of the merged Globe Stove & Range Works, Kokomo, and McComb Products Co., McComb, Ill. Other officers are: W. D. Harvey, president; W. S. Toomey, D. B. Tolley and A. J. Stilwell, vice presidents; E. F. Orem, secretary-treasurer; J. H. Risser, purchasing agent and assistant treasurer; Niota Wood, assistant secretary; Charles R. Curies, assistant sales manager; William Cooper, manager of sales promotion; James P. Thrayers, superintendent, Kokomo plant; and A. P. Scott, superintendent, McComb plant.

Charles T. Wilson has sailed for Selmaslistroy Rostov on the Don, Russia, to become supervisor of gray iron, malleable steel foundries making castings for the manufacture of har-

vesting machinery. Mr. Wilson is a native of Seattle, Wash., where he served his apprenticeship at the Vulcan Mfg. Co. In their employ, he rose to superintendency of the foundry. Later, he became associated with the Prescott Co. of the same city. He left Seattle to become connected with the Crawford & McCrimmin Co., Brazil, Ind. He resigned his position with that company to become general superintendent for the American Skein & Foundry Co., Racine, Wis. He occupied that position for 3 years, and then was appointed to the same position with the Superior Foundry Co., Cleveland.

A. W. Daniels, for the past 7 years general sales manager, American Manganese Steel Co., Chicago, has been appointed vice president in charge of sales. Mr. Daniels was born in Chicago where he attended the public schools. He left school at 13 years of age and engaged in various business persuits. For 7 years prior to his appointment as assistant to the industrial engineer at the Chicago Heights, Ill., plant of the company, he traveled extensively as a commercial representative. He became manager of the Chicago office of the American Manganese Steel Co. in 1920 and two years later was promoted to central states manager. He held that position for a year and in 1923 was appointed general sales manager, which position he held until his recent promotion.

F. T. Sisco, formerly chief of the research metallurgical laboratory, United States army air crops, Wright field, Dayton, O., has been appointed editor of the *Alloys of Iron Research* which was organized by the Engineering Foundation Inc., New York, for the purpose of furthering fundamental research on iron and its alloys. Mr. Sisco has had 16 years experience in the iron and steel industry including 10 years plant and laboratory experience with the Illinois Steel Co.; Hess Steel Corp.; United States Naval Ordnance plant; American Steel & Wire Co., and 6 years as chief of the research metallurgical laboratory, Wright field, Dayton. He is the author of several text books including *Technical Analysis of Steel and Steel Works Materials, Manufacture of Electric Steel, Metallurgy in Aircraft Construction, etc.* Mr. Sisco also is the author of 50 technical papers on various metallurgical subjects.

The American Monorail Co., Cleveland, recently opened an office at 3557 West Twenty-second street, Chicago, to handle sales in the midwest territory. Melvin E. Hartzler is in charge of the new branch of the company.

Equipment Developments Feature Show

(*Concluded from Page* 196)

UNITED STATES ELECTRICAL TOOL CO., Cincinnati—This company will display a disk drive variable speed grinder and buffer, a new line of flexible shaft equipment and a line of drills and portable grinders. Those in attendance will include H. O. Coe, G. Thornton, R. N. Brayer, T. H. Scaffe, F. Franklin, L. E. Fries, J. C. Goodman, G. E. Smith and R. H. Clore.

UNITED STATES GRAPHITE CO., Saginaw, Mich.—Mexican graphite, plumbagos, corewashes, etc., will be displayed. R. A. Corrigan, R. J. Edmiston, A. J. Heindel, R. M. Marble and O. R. Miller will represent the company.

UNIVERSAL SAND EQUIPMENT CO., Cleveland—This company will show various types of sand throwers and a sand hopper. Those items of equipment will be in operation. S. L. Dryfoos, E. P. Sawhill, M. A. Beltaire, C. M. Holcomb, E. J. Welter and W. C. Edgar will be in charge of the exhibit.

A. W. DANIELS

VAN DORN ELECTRICAL TOOL CO., Cleveland—Grinding equipment will be featured in the exhibit of this company.

VESUVIUS CRUCIBLE CO., Swissvale, Pa.—The exhibit of this company will include graphite crucibles and graphite stoppers. Representatives are H. C. Sorenson, J. R. Covert, A. W. Protheroe and H. E. Roemhild.

WADSWORTH CORE MACHINE & EQUIPMENT CO., Akron, O.—Motor driven core making machines, core cutting off and coping machines, motor driven core and bottom plates will feature this exhibit. G. H. Wadsworth and M. C. Sammons will be in charge.

J. D. WALLACE & CO., Chicago—This company will feature woodworking machinery in its exhibit.

JERVIS B. WEBB CO., Detroit—This company will show I-beam overhead conveyor systems in operation. Representatives will be Jervis B. Webb, T. Hegelmann and H. Boyd.

WESTINGHOUSE TRACTION BRAKE CO., Pittsburgh—Two 506 cubic feet, two-stage, motor driven, air compressors, a hydraulic press and other pneumatic devices will be exhibited. Representatives will be F. C. Young, S. B. Schrontz, W. C. Burriss, J. F. Ames and S. A. King Jr.

WHITE BROS. SMELTING CORP., Philadelphia—Brass and bronze ingot metals, copper ingots, and babbitt and other white metals will feature this display. Representatives will be Clarence B. White, Frank Krug, Raymond Hunter, Raymond Fritts and Frank Ogden.

WHITE ROCK SILICA CO., Chicago—Sandblast, glass, silica and foundry sands and silica flour will be shown. The firm will be represented by Robert Wehenn, Allen C. Wehenn, Walter Gerlinger and Harry R. Donald.

WHITEHEAD BROS. CO., Buffalo—This company will show samples of foundry sands and supplies with representative castings. Photographs also will be shown illustrating the mining and conditioning of molding sand and gravel. Representatives of the company will be C. E. Andrews, R. L. Carpenter, F. B. Clark, B. D. Fuller, A. Y. Gregory, A. J. Miller, A. J. Miller Jr., T. F. Hogan, R. J. Hashagen, A. J. McBride, E. H. Townson, J. H. Whitehead and V. L. Whitehead Jr.

WHITING CORP., Harvey, Ill.—A cupola charger in operation on a runway, a tumbler and dust filter, electric crane trolley, a model of the powdered fuel burning rotary furnace, ladles and charging buckets will feature the exhibit. The company will be represented by T. S. Hammond, A. H. McDougall, M. J. Evans, R. S. Hammond, E. C. Rice, F. M. McGee, A. DeYoung, O. L. Coffey, H. Madsen, C. Fralick, H. W. Benton, A. J. Brown, J. Munro, W. Nagell, H. K. Christie, Steve Hammond, J. H. Gougler, W. DeVries, D. J. Reese, R. E. Prussing, L. D. Reed, G. M. Dennis, R. H. Moore, F. P. Walsh, W. R. Hans, Paul Hyland, H. E. Reynolds, S. R. Vanderbeck, G. G. Crewson, A. E. Smith, J. R. Bates, D. Polderman Jr., M. F. Beetham, H. G. Mount, D. S. Mair, S. Donaldson, M. Pendergast, C. A. Hardy, W. R. Bean, M. F. Becker, C. R. Taylor, J. Harrington and Col. Mess.

WILBRAHAM-GREEN BLOWER CO., Pottstown, Pa.—A high-duty cupola blower with volume reducing and indicating mechanism, small blowers, positive displacement meters, models, parts and other equipment will be displayed. D. T. Jones, H. R. Jones and N. C. Barnard will represent the company.

G. H. WILLIAMS CO., Erie, Pa.—This company will display grab buckets for the handling of foundry materials.

E. J. WOODISON CO., Detroit—Parting compounds, core oils, core paste, facings, and snap flasks will be exhibited. Representatives will include J. C. Woodison, C. D. Yahne, G. A. Burman, W. J. Wark, R. S. Hoffman, M. E. Kohler, J. A. Carey, F. A. Blanchette and E. J. Woodison.

T. B. WOOD'S SONS CO., Chambersburg, Pa.—This company will display aluminum and cherry wood tapered slip flasks fitted with various types of pin equipment and automatic adjustable jackets. Charles M. Wood, Victor Leisher, George W. Leisher and H. M. Stickel will be at the booth.

WRIGHT MFG. CO., Bridgeport, Conn.—The features of this exhibit will be high speed, screw geared, differential hoists, army type trolley hoists, trolleys, cranes, etc. H. F. Wright, R. F. Straw and J. B. R. Smith will represent the company.

YALE & TOWNE MFG. CO., Stamford, Conn.—A line of hoists and industrial truck equipment will feature the display.

YOUNG BROS. CO., Detroit—Industrial oven equipment will be shown at the booth of this company.

ZANESVILLE SAND CO., Zanesville, O.—Samples of molding sand for gray iron, malleable, brass and aluminum castings, silica sand for steel molding and cores, silica flour, blast sand, steel abrasives, fire clay and core sand will be shown. The display will be in charge of Harry M. Flegal and Fred G. Flegal.

Trade Trends in Tabloid

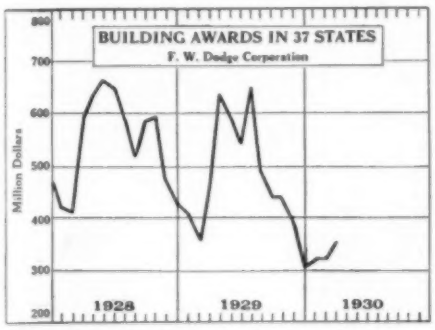
FOUNDRY operations are showing slight gains in certain sections. According to the Gray Iron institute, production of member companies averaged 94.6 per cent of normal in March as compared with 87 per cent in February.

—T—T—

Building construction is gaining. Awards in March totaled $459,119,000 as compared with $317,053,000 in February, a gain of approximately 50 per cent. The March total was the largest since last August.

—T—T—

Automobile production in March increased 24 per cent. The output of passenger cars for the month was 354,343. A rather cheerful sentiment



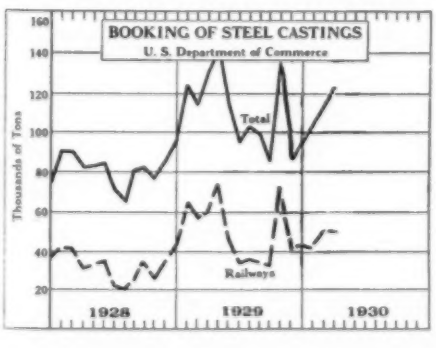
prevails among automobile manufacturers, since it is thought that improved business will develop with the coming warm weather. Ford and Chevrolet are accounting for 65 per cent of all production, according to *Iron Trade Review*.

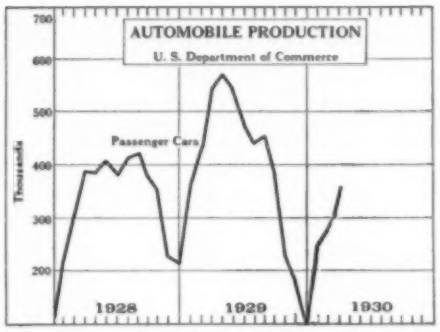
—T—T—

Anticipated early car buying by numerous leading roads such as the New York Central, the Pennsylvania, the Illinois Central and others, is expected to sustain present high operating rates of car shops well into the third quarter.

—T—T—

Pig iron sales during the week ending April 26 showed a tendency to slacken. Reports from various centers indicate that new business was





falling considerably behind that of recent weeks.

—T—T—

Recent reductions in the price of copper have failed to stimulate domestic buying to any marked extent. Further reductions are rumored and the trade appears to be watching the price trends closely.

—T—T—

The business situation at the middle of April shows little change as compared with a month ago, other than moderate seasonal improvement in retail trade and construction, according to a report of the conference of statisticians in industry operating under the auspices of the National Industrial Conference board.

—T—T—

Malleable iron production in March

RAW MATERIAL PRICES
April 23, 1930

Iron	
No. 2 foundry, Valley	$18.50
No. 2 Southern, Birmingham	14.00
No. 2 foundry, Chicago	19.50
No. 2 foundry, Philadelphia	20.26 to 20.76
No. 2 foundry, Buffalo	18.50
Basic, valley	18.50
Basic, Buffalo	18.00
Malleable, Chicago	19.50
Malleable, Buffalo	19.00
Coke	
Connellsville beehive coke	$3.50 to 4.85
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.50
Scrap	
Heavy melting steel, Valley	$16.00 to 16.50
Heavy melting steel, Pitts	15.75 to 16.00
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Buffalo	11.75 to 12.00
Stove plate, Chicago	10.00 to 10.50
No. 1 cast, New York	10.85
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	15.50
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 cast, Birmingham	13.00 to 14.00
Car wheels, iron, Pittsburgh	14.50 to 15.00
Car wheels, iron, Chicago	14.50 to 15.00
Railroad malleable, Chicago	16.50 to 17.00
Agricultural mal., Chicago	14.75 to 15.25
Malleable, Buffalo	17.00 to 17.50
Nonferrous Metals	**Cents per pound**
Casting, copper, refinery	13.50 to 13.62½
Electro, copper, producers	14.00
Straits, tin	35.62½ to 35.75
Lead, New York	5.50
Antimony, New York	7.50 to 7.62½
Nickel, electro	35.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	16.00 to 16.50
Zinc, East St. Louis, Ill.	4.75

was 63,449 tons compared with 65,938 tons in February, according to a report of the department of commerce.

—T—T—

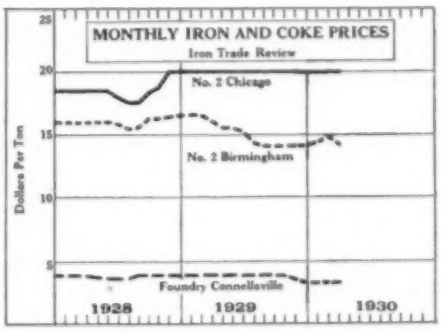
Purchases of brass ingots have slowed down somewhat in the Pittsburgh and the Chicago territories.

—T—T—

Orders received by the General Electric Co., Schenectady, N. Y., for the first quarter of 1930 amounted to $90,397,731 as compared with $101,365,208 during the corresponding three months last year.

—T—T—

Production of steel castings in March was 85 per cent of capacity compared with 80 per cent in Feb-



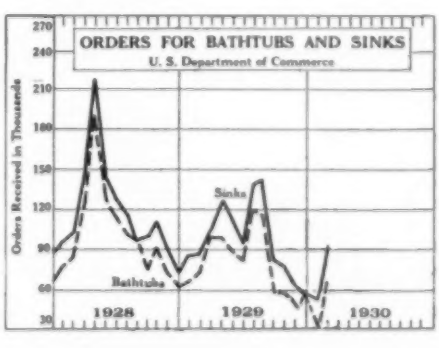
ruary and 90 per cent a year ago. Total production for the first three months was at the rate of 77 per cent of capacity as compared with 85 per cent during the similar period in 1926. Production in March, according to the department of commerce, was 122,844 tons.

—T—T—

Production of cast iron pipe in the Birmingham district was improving in April and buying of pig iron in that territory was heavier than in some months.

—T—T—

Steel plant operations continue at about the same rate as in March. A few companies have increased their bookings sufficiently to warrant a mild expansion in their operations.



What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Eagle Iron Works, Sylacauga, Ala., is erecting a pattern shop at its plant.

Mal-Gra Castings Co., Cambridge City, Ind., has been closed.

Stockholders of the Buck's Stove & Range Co., 3500 North Second street, St. Louis, have voted to liquidate the company.

Illinois Foundry Co., 2725 South Eleventh street, Springfield, Ill., recently suffered a slight damage by fire.

Johnson City Foundry & Machine Co., Johnson City, Tenn., is completing an addition to its plant and a new warehouse.

Ffint Foundry Co., Marshall, Mich., reports good business. The shop was closed for a few days because of repairs.

American Machine & Foundry Co., 5520 Second avenue, Brooklyn, N. Y. reported good business during 1929.

Acme Pattern & Mfg. Co., Dayton, O., has been incorporated by Robert K. Landis, Charles Hager and Irvin G. Bierser.

St. Louis Foundry Co., Breckenridge, Mich., has been reorganized and will be known as the Advance Castings Co.

Johnson Foundry & Machine Shop, Madison, Ind., recently booked a large steamship repair order.

Evansville Malleable Castings Co., 2549 East Colm street, Evansville, Ind., is understood to have plans drawn for a one-story foundry building. L. P. Edwards is manager.

Decatur Malleable Iron Co., Woodford and Curtis avenues, Decatur, Ill., recently suffered fire damage to its power unit, comprised of six motors.

American Steel Foundries, Inc., Chicago, plans to replace two of its present furnaces at the Granite City, Ill. plant with one new furnace. H. M. Rishel is works manager.

Manufacturers' Foundry Co., East Ninth and Fairbanks avenue, Holland, Mich., formerly a branch of the Western Foundry Co., Chicago, contemplates expansion.

Jacoby Pattern Works, Kansas City, Mo., manufacturers of wood and metal patterns, has moved from 1906 Wyandotte street, to Sixteenth and Walnut streets.

Dominion Stove & Foundry Co., Ltd., Penetanguishene, Ont., manufacturer of stoves and ranges, is reported planning the construction of a plant to cost about $100,000.

Metal Cast Products Co., 1696 Boston road, New York, maker of molds, castings, and metal toys, recently suffered a fire damage to its plant and equipment.

Hill Clutch Machine & Foundry Co., West Sixty-fifth street and Breakwater avenue, Cleveland has reopened its New York office under the direction of A. L. Whiteside.

Kansas City Aluminum Co., 1404 McGee St., Kansas City, Mo., has been incorporated with $50,000 capital by E. J. Lind, 2114 North Thirteenth street, to operate an aluminum and metal foundry.

Model Brass Foundry, 232 East Decatur street, Decatur, Ill., recently has completed the construction of a furnace room, 45 x 20 feet. The company also has installed sandblast equipment. E. M. McKelvey is manager.

Erie Foundry Co., West Twelfth street, Erie, Pa., maker of automotive castings and equipment has awarded the contract to H. Rommerdale Construction Co., for a one-story addition, 62 x 80 feet, costing approximately $20,000.

Stover Mfg. & Engine Co., Freeport, Ill., showed a material increase in business in 1929 over the previous year. Profits exceeded by approximately $100,000 the corresponding figure for the previous year.

The foundry of the Rock Island Plow Co., Sixth street and Second avenue, Rock Island, Ill., recently was damaged by fire to the extent of $25,000. The blaze was confined to the charging floor, electric motors, cupola and patterns.

The plant of the Superior Foundry Co., 500 Watson street, Grand Rapids, Mich., has been taken over by the Consumers' Power Co., 129 Pearl street, Grand Rapids, and will be equipped as a plant for the rewinding of motors.

A. P. Grimm Foundry Co., Bound Brook, N. J., has taken over the South Plainfield, N. J., plant of the Spicer Mfg. Co. and will use it for the production of brass and aluminum castings. The new building has 60,000 square feet of floor space.

Chemical Equipment Co., Chicago, manufacturers of chemical machinery, acid pumps, valves, etc., has purchased the Montpelier Foundry & Machine Co. plant at Montpelier, Ind., and will move its facilities there. The foundry will be reopened shortly.

Eygptian Foundry & Mfg. Co., Scheel street, Belleville, Ill., recently incorporated to operate a gray iron foundry, is installing equipment in its plant. The company was expected to be in operation by April 25. Minard Van Eizenga is manager.

Advance-Rumely Co., La Porte, Ind., manufacturer of farm machinery, will close its plant at Battle Creek, Mich., permanently as soon as production schedules can be rearranged. Manufacturing operations of the company are to be concentrated at La Porte.

Wheatley Bros. Brass & Metal Works, 24 North Owasso street, Tulsa, Okla., has started the construction of a structural steel shop building, 83 x 160 feet, on Sand Springs road. DeWitt & Howard have been awarded the general contract.

Baker-Nagle Stove Works, Freeburg and Van Buren streets, Belleville, Ill., has erected a 2-story fireproof storage building, 140 x 165 feet, and has installed a sprinkler system. Walter G. Nagle is general manager and A. B. Herman is superintendent.

Robert Mitchell Co., Ltd., 750 Bellaire St., Montreal, Que., brass foundry operators, has let the contract to C. E. Deakin, 1440 St. Catherine street west, for the erection of a plant addition. The structural steel contract has been awarded to the Dominion Bridge Co., Lachine, Que. (Noted April 1.)

Automotive Foundry, LaCrosse, Wis., specializing in castings for marine, industrial and other heavy-duty gasoline engines, has started work on a 1-story addition, 50 x 140 feet, to be equipped exclusively for machining processes, and thus release the present machine shop space for casting purposes. Emil Rasmussen is president and general manager.

Keen Foundry Co., Griffith, Ind., Louis F. Keen, president, recently purchased a four-acre tract formerly owned by the Griffith Steel Co. The plot will be improved with a new building and alterations. Work will be started on the project this spring. It is estimated that the new construction will cost about $50,000.

Atterbury Corp., Black Lick, Pa., has started work on a steel plant, costing approximately $300,000, for the manufacture of cast and forged steel, valves and fixtures for the oil field equipment. Several abandoned buildings have been reconditioned and other units are being constructed. Edward T. Ryan, 732 Bayridge avenue, Pittsburgh, is secretary and treasurer.

Potter Foundry Co., Albert Lea, Minn., has been organized to manufacture gray iron castings. Officers of the company include D. A. Potter, president; Catherine P. Burrell, vice president; and O. W. Potter, secretary-treasurer. The previously mentioned officers of the company and H. C. Hanson and William P. Sturtz constitute the board of directors.

Falk Corp., Milwaukee, is completing preparations for casting the largest gear it has ever attempted to make. The gear is a part of a steel mill drive ordered by the Aluminum Co. of America, and will be 15½ feet in diameter, with a 48-inch base. It will require pouring of 136,000 pounds of steel, the rough weight will be 91,000 pounds and the finished gear will weigh 68,000 pounds.

Bay City Foundry Co., Bay City, Mich., has been organized to take over the foundry division of the Bay City Foundry & Machine Co. The machine division will be continued under a separate organization. The new foundry company includes Charles T. Clark and Luther G. Beckwith. The machine company will be in charge of Charles B. Curtiss. Mr. Clark will have charge of the office work of the new foundry company and Mr. Beckwith will be in charge of sales. Donald W. Clark will be foundry manager.

New Trade Publications

STAINLESS STEEL CASTINGS — Shawinigan Stainless Steel & Alloys, Ltd., Shawinigan Falls, Que., has published a folder which gives a history of the company, equipment and the alloy steels produced. The company specializes in steels and irons for heat and acid resistance.

ALUMINUM CASTING ALLOYS—The Aluminum Co. of America, Pittsburgh, just has published a 30-page bulletin giving information on the various aluminum casting alloys that it manufactures. It includes uses and advantages, hardeners and their effects, standard alloys, general foundry principles and miscellaneous physical data.

ARC WELDING—General Electric Co., Schenectady, N. Y., recently has issued two folders on its arc welding equipment. One describes a belt, motor or gas engine driven, stationary or portable, self-excited, variable-voltage, single operator machine equipped with alternating current motor with a rating of 200 amperes, 25 volts. The second folder describes a set of the same type but with a 300 ampere rating.

SAND EQUIPMENT—Universal Sand Equipment Co., 1833 Columbus road, Cleveland, has issued a catalog on its sand handling and conditioning equipment. The booklet is illustrated with half-tones of the various types of equipment and typical installations. Data on the various types of sand throwing machines, details of construction, layouts for sand handling systems, letters from some of the users of its equipment and a list of users are included in the catalog.